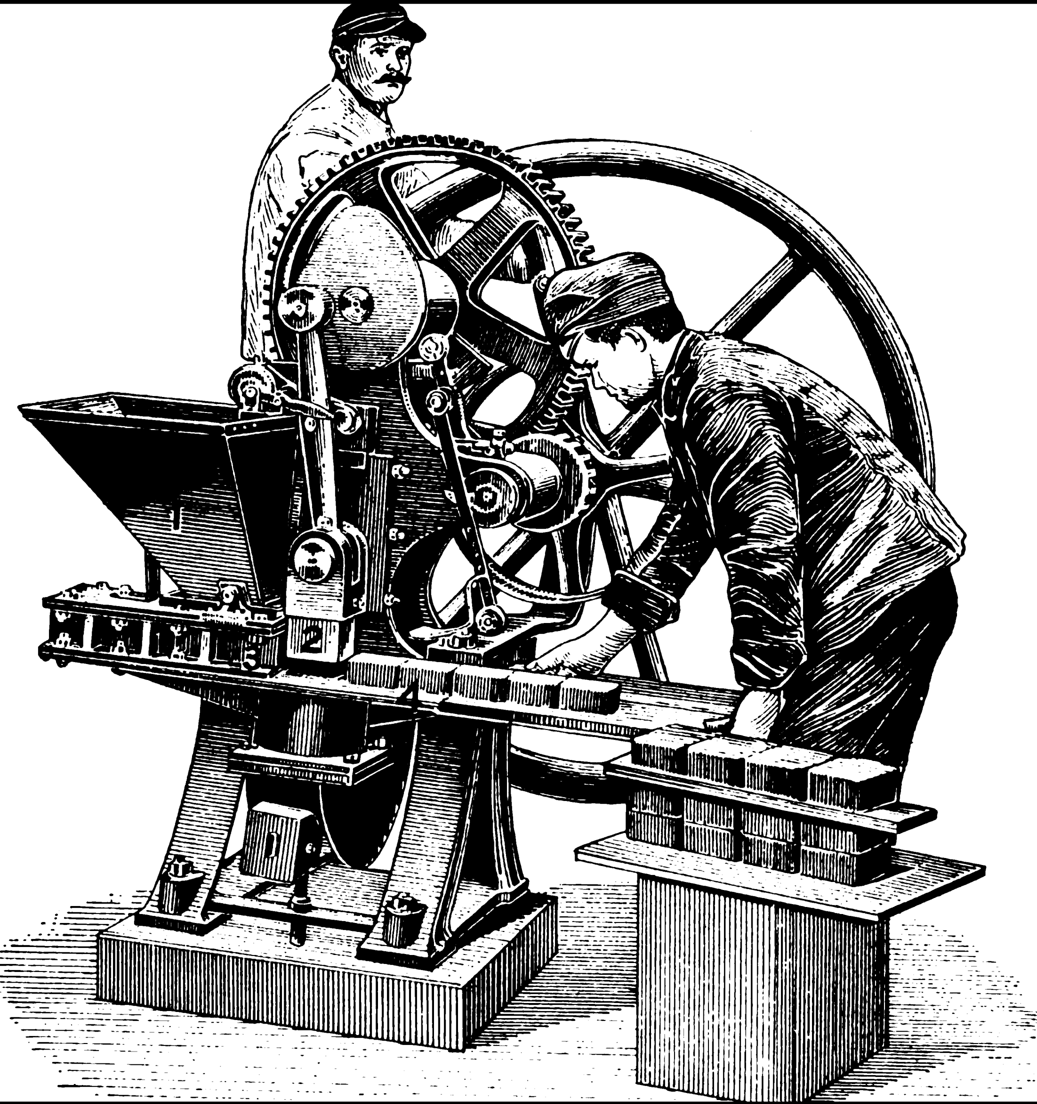

Special consular reports

United States. Bureau of Foreign Commerce,
United States. Dept. of Commerce and Labor. ...

SPECIAL CONSULAR REPORTS.

BRIQUETTES AS FUEL

IN

FOREIGN COUNTRIES.

VOL. XXVI.

REPORTS FROM CONSULS OF THE UNITED STATES IN ANSWER TO INSTRUCTIONS FROM THE DEPARTMENT OF STATE.

Issued from the Bureau of Foreign Commerce,
Department of State.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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Stone & Webster

CONTENTS.

PUBLICATIONS OF THE BUREAU OF FOREIGN COMMERCE.[a]

The publications of the Bureau of Foreign Commerce, Department of State, are:

I.—COMMERCIAL RELATIONS, being the annual reports of consular officers on the commerce, industries, navigation, etc., of their districts.

II.—CONSULAR REPORTS, issued monthly, and containing miscellaneous reports from diplomatic and consular officers.

III.—ADVANCE SHEETS, CONSULAR REPORTS, issued daily, except Sundays and legal holidays, for the convenience of the newspaper press, commercial and manufacturing organizations, etc.

IV.—EXPORTS DECLARED FOR THE UNITED STATES, issued quarterly, and containing the declared values of exports from the various consular districts to the United States for the preceding three months. There is also issued an annual edition of Declared Exports, embracing the returns for the fiscal year.

V.—SPECIAL CONSULAR REPORTS, containing series of reports from consular officers on particular subjects, made in pursuance to instructions from the Department.

Following are the special publications issued by the Bureau prior to 1890:

Labor in Europe, 1878, one volume; Labor in Foreign Countries, 1884, three volumes; Commerce of the World and the Share of the United States therein, 1879; Commerce of the World and the Share of the United States Therein, 1880–81; Declared Exports for the United States, First and Second Quarters, 1883; Declared Exports for the United States, Third and Fourth Quarters, 1883; Cholera in Europe in 1884, 1885; Trade Guilds of Europe, 1885; The Licorice Plant, 1885; Forestry in Europe, 1887; Emigration and Immigration, 1885–86 (a portion of this work was published as CONSULAR REPORTS No. 76, for the month of April, 1887); Rice Pounding in Europe, 1887; Sugar of Milk, 1887; Wool Scouring in Belgium, 1887; Cattle and Dairy Farming in Foreign Countries, 1888 (issued first in one volume, afterwards in two volumes); Technical Education in Europe, 1888; Tariffs of Central America and the British West Indies, 1890.

The editions of all these publications, except Tariffs in Central America, etc., are exhausted, and the Department is, therefore, unable to supply copies.

In 1890 the Department decided to publish reports on special subjects in separate form, to be entitled SPECIAL CONSULAR REPORTS. There are now the following SPECIAL CONSULAR REPORTS:

Vol. 1 (1890).—Cotton Textiles in Foreign Countries, Files in Spanish America, Carpet Manufacture in Foreign Countries, Malt and Beer in Spanish America, and Fruit Culture in Foreign Countries.

Vol. 2 (1890 and 1891).—Refrigerators and Food Preservation in Foreign Countries, European Emigration, Olive Culture in the Alpes Maritimes, and Beet-Sugar Industry and Flax Cultivation in Foreign Countries.

Vol. 3 (1891).—Streets and Highways in Foreign Countries. (New edition, 1897.)

Vol. 4 (1891).—Port Regulations in Foreign Countries.

Vol. 5 (1891).—Canals and Irrigation in Foreign Countries. (New edition, 1898.)

Vol. 6 (1891 and 1892).—Coal and Coal Consumption in Spanish America, Gas in Foreign Countries, and India Rubber.

Vol. 7 (1892).—The Stave Trade in Foreign Countries and Tariffs of Foreign Countries.

Vol. 8 (1892).—Fire and Building Regulations in Foreign Countries.

Vol. 9 (1892 and 1893).—Australian Sheep and Wool, and Vagrancy and Public Charities in Foreign Countries.

Vol. 10 (1894).—Lead and Zinc Mining in Foreign Countries and Extension of Markets for American Flour. (New edition, 1897.)

Vol. 11 (1894).—American Lumber in Foreign Markets. (New edition, 1897.)

Vol. 12 (1895).—Highways of Commerce. (New edition, 1899.)

Vol. 13 (1896 and 1897).—Money and Prices in Foreign Countries.

Vol. 14 (1898).—The Drug Trade in Foreign Countries.

Vol. 15 (1898).—Part I. Soap Trade in Foreign Countries; Screws, Nuts, and Bolts in Foreign Countries; Argols in Europe; Rabbits and Rabbit Furs in Europe, and Cultivation of Ramie in Foreign Countries. Part II. Sericulture and Silk Reeling and Cultivation of the English Walnut.

Vol. 16 (1899).—Tariffs of Foreign Countries. Part I. Europe. Part II. America. Part III. Asia, Africa, Australasia, and Polynesia. Supplement (1900). Tariffs of Chile and Nicaragua.

Vol. 17 (1899).—Disposal of Sewage and Garbage in Foreign Countries; Foreign Trade in Coal Tar and By-Products.

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[a] Formerly Bureau of Statistics. Name changed to Bureau of Foreign Commerce by order of the Secretary of State, July 1, 1897.

Vol. 18 (*1900*).—Merchant Marine of Foreign Countries.

Vol. 19 (*1900*).—Paper in Foreign Countries; Uses of Wood Pulp.

Vol. 20 (*1900*).—Part I. Book Cloth in Foreign Countries; Market for Ready-Made Clothing in Latin America; Foreign Imports of American Tobacco, and Cigar and Cigarette Industry in Latin America. Part II. School Gardens in Europe. Part III. The Stave Trade in Foreign Countries.

Vol. 21 (*1900*).—Part I. Foreign Markets for American Coal. Part II. Vehicle Industry in Europe. Part III. Trusts and Trade Combinations in Europe.

Vol. 22 (*1900 and 1901*).—Part I. Acetic Acid in Foreign Countries. Part II. Mineral Water Industry. Part III. Foreign Trade in Heating and Cooking Stoves.

Vol. 23 (*1901*).—Part I. Gas and Oil Engines in Foreign Countries. Part II. Silver and Plated Ware.

Vol. 24 (*1902*).—Creameries in Foreign Countries.

Vol. 25 (*1902*).—Stored Goods as Collateral for Loans.

Of these SPECIAL CONSULAR REPORTS, Australian Sheep and Wool, Cotton Textiles in Foreign Countries, Files in Spanish America, Fire and Building Regulations, Fruit Culture, Gas in Foreign Countries, India Rubber, Lead and Zinc Mining, Malt and Beer in Spanish America, Port Regulations, Refrigerators and Food Preservation; Sericulture, etc.; Vagrancy, etc., are exhausted, and no copies can be supplied by the Department.

There was also published, in 1899, Proclamations and Decrees during the War with Spain, comprising neutrality circulars issued by foreign countries, proclamations by the President, orders of the War and Navy Departments, and War decrees of Spain.

Of the monthly CONSULAR REPORTS, many numbers are exhausted or so reduced that the Department is unable to accede to requests for copies. Of the publications of the Bureau available for distribution, copies are mailed to applicants without charge. In view of the scarcity of certain numbers, the Bureau will be grateful for the return of any copies of the monthly or special reports which recipients do not care to retain. Upon notification of willingness to return such copies, the Department will forward franking labels to be used in lieu of postage in the United States, Canada, the Hawaiian Islands, Porto Rico, and Mexico.

Persons receiving CONSULAR REPORTS regularly, who change their addresses, should give the old as well as the new address in notifying the Bureau of the fact.

In order to prevent confusion with other Department bureaus, all communications relating to Consular Reports should be carefully addressed, "Chief, Bureau of Foreign Commerce, Department of State, Washington, U. S. A."

VALUES OF FOREIGN COINS AND CURRENCIES.

The following statements show the valuation of foreign coins, as given by the Director of the United States Mint and published by the Secretary of the Treasury, in compliance with the first section of the act of March 3, 1873, viz: "That the value of foreign coins, as expressed in the money of account of the United States, shall be that of the pure metal of such coin of standard value," and that "the value of the standard coins in circulation of the various nations of the world shall be estimated annually by the Director of the Mint, and be proclaimed on the 1st day of January by the Secretary of the Treasury."

In compliance with the foregoing provisions of law, annual statements were issued by the Treasury Department, beginning with that issued on January 1, 1874, and ending with that issued on January 1, 1890. Since that date, in compliance with the act of October 1, 1890, these valuation statements have been issued quarterly, beginning with the statement issued on January 1, 1891.

The fact that the market exchange value of foreign coins differs in many instances from that given by the United States Treasury has been repeatedly called to the attention of the Bureau of Foreign Commerce. An explanation of the basis of the quarterly valuations was asked from the United States Director of the Mint, and under date of February 7, 1898, Mr. R. E. Preston made the following statement:

"When a country has the single gold standard, the value of its standard coins is estimated to be that of the number of grains fine of gold in them, 480 grains being reckoned equivalent to $20.67 in United States gold, and a smaller number of grains in proportion. When a country has the double standard, but keeps its full legal-tender silver coins at par with gold, the coins of both gold and silver are calculated on the basis of the gold value.

"The value of the standard coins of countries with the single silver standard is calculated to be that of the average market value of the pure metal they contained during the three months preceding the date of the proclamation of their value in United States gold by the Secretary of the Treasury. The value of the gold coins of silver-standard countries is calculated at that of the pure gold they contain, just as if they had the single gold standard."

"These valuations are used in estimating the values of all foreign merchandise exported to the United States."

The following statements, running from January 1, 1874, to January 1, 1903, have been prepared to assist in computing the values in American money of the trade, prices, values, wages, etc., of and in foreign countries, as given in consular and other reports. The series of years are given so that computations may be made for each year in the proper money values of such year. In hurried computations the reductions of foreign currencies into American currency, no matter for how many years, are too often made on the bases of latest valuations. All computations of values, trade, wages, prices, etc., of and in the "fluctuating-currency countries" should be made in the values of their currencies in each year up to and including 1898, and in the quarterly valuations thereafter.

To meet typographical requirements, the quotations for the years 1875–1877, 1879–1882, 1884–1887, 1895, 1897, and 1899 are omitted, these years being selected as showing the least fluctuations when compared with years immediately preceding and following.

To save unnecessary repetition, the estimates of valuations are divided into three classes, viz, (A) countries with fixed currencies, (B) countries with fluctuating currencies, and (C) quarterly valuations of fluctuating currencies.

A.—*Countries with fixed currencies.*

The following official (United States Treasury) valuations of foreign coins do not include "rates of exchange."

Countries.	Standard.	Monetary unit.	Value in United States gold.	Coins.
Argentine Republic	Gold and silver	Peso	$0.96,5	Gold—argentine ($4.82,4) and ½ argentine; silver—peso and divisions.
Austria-Hungary [a]	Gold	Crown	.20,3	Gold—20 crowns ($4.05,2) and 10 crowns.
Belgium	Gold and silver	Franc	.19,3	Gold—10 and 20 franc pieces; silver—5 francs.
Brazil	Gold	Milreis	.54,6	Gold—5, 10, and 20 milreis; silver—½, 1, and 2 milreis.
British North America (except Newfoundland).	do	Dollar	1.00	
British Honduras	do	do	1.00	
Chile	do	Peso	.36,5	Gold—escudo ($1.25), doubloon ($3.65), and condor ($7.30); silver—peso and divisions.
Costa Rica	do	Colon	.46,5	Gold—2, 5, 10, and 20 colons; silver—5, 10, 25, and 50 centisimos.
Cuba	Gold and silver	Peso	.92,6	Gold—doubloon ($5.01,7); silver—peso (60 cents).
Denmark	Gold	Crown	.26,8	Gold—10 and 20 crowns.
Ecuador [b]	do	Sucre	.48,7	Gold—10 sucres ($4.8665); silver—sucre and divisions.
Egypt	do	Pound (100 piasters).	4.94,3	Gold—10, 20, 50, and 100 piasters; silver—1, 2, 10, and 20 piasters.
Finland	do	Mark	.19,3	Gold—10 and 20 marks ($1.93 and $3.85,9).
France	Gold and silver	Franc	.19,3	Gold—5, 10, 20, 50, and 100 francs; silver—5 francs.
Germany	Gold	Mark	.23,8	Gold—5, 10, and 20 marks.
Great Britain	do	Pound sterling	4.86,6½	Gold—sovereign (pound sterling) and half sovereign.
Greece	Gold and silver	Drachma	.19,3	Gold—5, 10, 20, 50, and 100 drachmas; silver—5 drachmas.
Haiti	do	Gourde	.96,5	Silver—gourde.
India [c]	Gold	Rupee	.32,4	Gold—sovereign ($4.8665); silver—rupee and divisions.
Italy	Gold and silver	Lira	.19,3	Gold—5, 10, 20, 50, and 100 lire; silver—5 lire.
Japan [d]	Gold	Yen	.49,8	Gold—1, 2, 5, 10, and 20 yen.
Liberia	do	Dollar	1.00	
Netherlands	Gold and silver	Florin	.40,2	Gold—10 florins; silver—½, 1, and 2½ florins.
Newfoundland	Gold	Dollar	1.01,4	Gold—$2 ($2.02,7).
Peru [e]	do	Sol	.48,7	Gold—libra ($4.8665); silver—sol and divisions.
Portugal	do	Milreis	1.08	Gold—1, 2, 5, and 10 milreis.
Russia [f]	do	Ruble	.51,5	Gold—imperial ($7.718) and ½ imperial ($3.80); silver—¼, ½, and 1 ruble.
Spain	Gold and silver	Peseta	.19,3	Gold—25 pesetas; silver—5 pesetas.
Sweden and Norway	Gold	Crown	.26,8	Gold—10 and 20 crowns.
Switzerland	Gold and silver	Franc	.19,3	Gold—5, 10, 20, 50, and 100 francs; silver—5 francs.
Turkey	Gold	Piaster	.04,4	Gold—25, 50, 100, 200, and 500 piasters.
Uruguay	do	Peso	1.03,4	Gold—peso; silver—peso and divisions.
Venezuela	Gold and silver	Bolivar	.19,3	Gold—5, 10, 20, 50, and 100 bolivars; silver—5 bolivars.

[a] The gold standard went into effect January 1, 1900. (See Commercial Relations, 1899, Vol. II, p. 7.) Values are still sometimes expressed in the florin, which is worth 2 crowns

[b] Gold standard adopted in November, 1900. (See Consular Reports, No. 225, June, 1899.)

[c] For an account of the adoption of the gold standard see Consular Reports, No. 238, p. 359.

[d] Gold standard adopted October 1, 1897. (See Consular Reports, No. 201, p. 259.)

[e] Gold standard adopted October 13, 1900.

[f] For an account of the adoption of the gold standard, see Review of the World's Commerce, 1896–97, p. 254.

B.—*Countries with fluctuating currencies, 1874–1898.*

Countries.	Standard.	Monetary unit.	Value in terms of the United States gold dollar on January 1—					
			1874.	1878.	1883.	1888.	1889.	1890.
Austria-Hungary[a]	Silver	Florin	$0.47,6	$0.45,3	$0.40,1	$0.34,5	$0.33,6	$0.42
Bolivia	do	Dollar until 1880; boliviano thereafter.	.96,5	.96,5	.81,2	.69,9	.68	.85
Central America	do	Peso	.96,5	.91,8	....	.69,9	.68	.85
China	do	Haikwan tael	1.61	....	....	....	....	....
Colombia	do	Peso	.96,5	.96,5	.81,2	.69,9	.68	.85
Ecuador	do	do	.96,5	.91,8	.81,2	.69,9	.68	.85
Egypt[b]	Gold	Pound (100 piasters).	....	4.97,4	4.90	4.94,3	....	....
India	Silver	Rupee	.45,8	.43,6	.38,6	.32,2	.32,3	.40,4
Japan	Gold	Yen	.99,7	.99,7	....	.99,7	.99,7	.99.7
	Silver		....	....	.87,6	.75,3	.73,4	.91,7
Mexico	do	Dollar	1.04,7½	.99,8	.88,2	.75,9	.73,9	.92,3
Netherlands[c]	Gold and silver.	Florin	.40,5	.38,5	....	....	....	....
Peru	Silver	Sol	.92,5	.91,8	.81,2	.69,9	.68	.85
Russia	do	Ruble	.77,17	.73,4	.65	.55,9	.54,4	.68
Tripoli	do	Mahbub of 20 piasters.	.87,09	.82,9	.73,3	.63	.61,4	.76,7

Countries.	Standard.	Monetary unit.	Value in terms of the United States gold dollar on January 1—					
			1891.	1892.	1893.	1894.	1896.	1898.
Austria-Hungary[a]	Silver	Florin	$0.38,1	$0.34,1	....	....	....	....
Bolivia	do	Boliviano	.77,1	.69,1	$0.61,3	$0.51,6	$0.49,1	$0.42,4
Central America	do	Peso	.77,1	.69,1	61,3	.51,6	.49,1	.41,4
Colombia	do	do	.77,1	.69,1	.61,3	.51,6	.49,1	.42,4
Ecuador	do	do	.77,1	.69,1	.61,3	.51,6	.49,1	.42,4
India	do	Rupee	.36,6	.32,8	.29,2	.24,5	.23,3	.20,1
Japan[d]	do	Yen	.83,1	.74,5	.66,1	.55,6	.52,9	....
Mexico	do	Dollar	.83,7	.75	.66,6	56	.53,3	.46
Peru	do	Sol	.77,1	.69,1	.61,3	.51,6	.49,1	.42,4
Russia[d]	do	Ruble	.61,7	.55,3	.49,1	.41,3	.39,3	....
Tripoli	do	Mahbub of 20 piasters.	.69,5	.62,3	.55,3	.46,5	.44,3	....

[a] The silver standard prevailed in Austria-Hungary up to 1892. The law of August 2 of that year (see Consular Reports, No. 147, p. 623) established the gold standard.
[b] The Egyptian pound became fixed in value at $4.94,3 in 1887.
[c] The Netherlands florin fluctuated up to the year 1880, when it became fixed at 40.2 cents.
[d] See footnote, table of fixed currencies.

C.—*Quarterly valuations of fluctuating currencies.*

Countries.	Monetary unit.	1900.				1901.			
		Jan. 1.	Apr. 1.	July 1.	Oct. 1.	Jan. 1.	Apr. 1.	July 1.	Oct. 1.
Bolivia	Silver boliviano	$0.42,7	$0.43,6	$0.43,8	$0.45,1	$0.46,8	$0.45,1	$0.43,6	$0.42,8
Central America.	Silver peso	.42,7	.43,6	.43,8	.45,1	.46,5	.45,1	.43,6	.42,8
China	Amoy tael	.69,1	.70,5	.70,9	.72,9	.75,7	.72,9	.70,5	.69,1
	Canton tael	.68,9	.70,3	.70,7	.72,7	.75,5	.72,7	.70,3	.68,9
	Chefoo tael	.66,1	.67,4	.67,8	.69,7	.72,4	.69,7	.67,4	.66,1
	Chinkiang tael	.67,5	.68,8	.69,3	.71,2	.74	.71,2	.68,8	.67,5
	Fuchau tael	.64	.65,2	.65,6	.67,4	.70,1	.67,5	.65,2	.64
	Haikwan tael	.70,3	.71,7	.72,1	.74,2	.77,1	.74,2	.71,7	.70,4
	Hankau tael	.64,7	.65,9	.66,3	.68,2	.70,9	.68,2	.65,9	.64,7
	Hongkong tael	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
	Ningpo tael	.66,5	.67,7	.68,2	.70,1	.72,8	.70,1	.67,8	.66,5
	Niuchwang tael	.64,8	.66,1	.66,5	.68,4	.71	.68,4	.66,1	.64,8
	Shanghai tael	.63,1	.64,4	.64,8	.66,6	.69,2	.66,6	.64,4	.63,2
	Swatow tael	.63,9	.65,1	.65,5	.67,4	.70	.67,4	.65,1	.63,9
	Takao tael	.69,6	.70,9	.71,4	.73,4	.76,2	.73,4	.70,9	.69,6
	Tientsin tael	.67	.68,3	.68,7	.70,7	.73,4	.70,7	.68,3	.67
Colombia	Silver peso	.42,7	.43,6	.43,8	.45,1	.46,8	.45,1	.43,6	.42,8
India	Silver rupee[b]	.20,3	.20,7	.20,8	....	....	....	....	....
Mexico	Silver dollar	.46,4	.47,3	.47,6	.49	.50,9	.49	.49	.46,4
Persia	Silver kran	.07,9	.08	.08,1	.08,3	.08,6	.08,3	.08,3	.07,9
Peru[c]	Silver sol	.42,7	.43,6	.43,8	.48,7	....	....	....	....

Countries.	Monetary unit.	1902.				1903.
		Jan. 1.	Apr. 1.	July 1.	Oct. 1.	Jan. 1.
Bolivia	Silver boliviano	$0.41,3	$0.40,3	$0.38,2	$0.38,4	$0.36,1
Central America	Silver peso	.41,3	.40,3	.38,2	.38,4	.36,1
China	Amoy tael	.66,9	.65,1	.61,8	.62	.58,4
	Canton tael	.66,7	.64,9	.61,7	.69	.58,2
	Chefoo tael	.63,9	.62,3	.59,1	.59,3	.55,8
	Chinkiang tael	.65,3	.63,6	.60,4	.60,6	.57
	Fuchau tael	.61,8	.60,2	.57,2	.57,4	.54
	Haikwan tael	.68	.66,3	.62,9	.63,1	.59,4
	Hankau tael	.62,6	.60,9	.57,9	.58	.54,6
	Hongkong tael	(a)	(a)	(a)	(a)	(a)
	Ningpo tael	.64,3	.62,6	.59,5	.59,6	.56,1
	Niuchwang tael	.62,7	.61,1	.58	.58,2	.53,3
	Shanghai tael	.61,1	.59,5	.56,5	.56,7	.53,9
	Swatow tael	.61,8	.60,2	.57,1	.57,3	.58,8
	Takao tael	.67,3	.65,5	.62,2	.62,4	.56,6
	Tientsin tael	.64,8	.63,1	.59,9	.60,1	.60,1
Colombia	Silver peso	.41,3	.40,3	.38,2	.38,4	.36,1
Mexico	Silver dollar	.44,9	.43,7	.41,5	.41,7	.39,2
Persia	Silver kran	.07,6	.07,4	.07	.07,1	.06,6

[a] The "British dollar" has the same legal value as the Mexican dollar in Hongkong, the Straits Settlements, and Labuan.
[b] The sovereign is the standard coin of India, but the rupee is the money of account. See also table of fixed currencies.
[c] See footnote, table of fixed currencies.

FOREIGN WEIGHTS AND MEASURES.

The following table embraces only such weights and measures as are given from time to time in Consular Reports and in Commercial Relations:

Foreign weights and measures, with American equivalents.

Denominations.	Where used.	American equivalents.
Almude	Portugal	4.422 gallons.
Ardeb	Egypt	7.6907 bushels.
Are	Metric	0.02471 acre.
Arobe	Paraguay	25 pounds.
Arratel or libra	Portugal	1.011 pounds.
Arroba (dry)	Argentine Republic	25.3175 pounds.
Do	Brazil	32.38 pounds.
Do	Cuba	25.3664 pounds.
Do	Portugal	32.38 pounds.
Do	Spain	25.36 pounds.
Do	Venezuela	25.4024 pounds.
Arroba (liquid)	Cuba, Spain, and Venezuela	4.263 gallons.
Arshine	Russia	28 inches.
Arshine (square)	do	5.44 square feet.
Artel	Morocco	1.12 pounds.
Barril	Argentine Republic and Mexico	20.0787 gallons.
Barrel	Malta (customs)	11.4 gallons.
Do	Spain (raisins)	100 pounds.
Berkovets	Russia	361.12 pounds.
Bongkal	India	832 grains.
Bouw	Sumatra	7,096.5 square meters.
Bu	Japan	0.1 inch.
Butt (wine)	Spain	140 gallons.
Caffiso	Malta	5.4 gallons.
Candy	India (Bombay)	529 pounds.
Do	India (Madras)	500 pounds.
Cantar	Morocco	113 pounds.
Do	Syria (Damascus)	575 pounds.
Do	Turkey	124.7036 pounds.
Cantaro (cantar)	Malta	175 pounds.
Carga	Mexico and Salvador	300 pounds.
Catty	China	1.333⅓ (1⅓) pounds.
Do [a]	Japan	1.31 pounds.
Do	Java, Siam, and Malacca	1.35 pounds.
Do	Sumatra	2.12 pounds.
Centaro	Central America	4.2631 gallons.
Centner	Bremen and Brunswick	117.5 pounds.
Do	Darmstadt	110.24 pounds.
Do	Denmark and Norway	110.11 pounds.
Do	Nuremberg	112.43 pounds.
Do	Prussia	113.44 pounds.
Do	Sweden	93.7 pounds.
Do	Vienna	123.5 pounds.
Do	Zollverein	110.24 pounds.
Do	Double or metric	220.46 pounds.
Chetvert	Russia	5.7748 bushels.
Chih	China	14 inches.
Coyan	Sarawak	3,098 pounds.
Do	Siam (Koyan)	2,667 pounds.
Cuadra	Argentine Republic	4.2 acres.
Do	Paraguay	78.9 yards.
Do	Paraguay (square)	8.077 square feet.
Do	Uruguay	Nearly 2 acres.
Cubic meter	Metric	35.3 cubic feet.
Cwt. (hundredweight)	British	112 pounds.
Dessiatine	Russia	2.6997 acres.
Do	Spain	1.599 bushels.
Drachme	Greece	Half ounce.
Egyptian weights and measures	(See Consular Reports, No. 144.)	

[a] More frequently called "kin." Among merchants in the treaty ports it equals 1.33⅓ pounds avoirdupois.

Foreign weights and measures, with American equivalents—Continued.

Denominations.	Where used.	American equivalents.
Fanega (dry)	Central America	1.5745 bushels.
Do	Chile	2.575 bushels.
Do	Cuba	1.599 bushels.
Do	Mexico	1.54728 bushels.
Do	Morocco	Strike fanega, 70 lbs.; full fanega, 118 lbs.
Do	Uruguay (double)	7.776 bushels.
Do	Uruguay (single)	3.888 bushels.
Do	Venezuela	1.599 bushels.
Fanega (liquid)	Spain	16 gallons.
Feddan	Egypt	1.03 acres.
Frail (raisins)	Spain	50 pounds.
Frasco	Argentine Republic	2.5096 quarts.
Do	Mexico	2.5 quarts.
Frasila	Zanzibar	35 pounds.
Fuder	Luxemburg	264.17 gallons.
Funt	Russia	0.9028 pound.
Garnice	Russian Poland	0.88 gallon.
Gram	Metric	15.432 grains.
Hectare	do	2.471 acres.
Hectoliter:		
Dry	do	2.838 bushels.
Liquid	do	26.417 gallons.
Joch	Austria-Hungary	1.422 acres.
Ken	Japan	6 feet.
Kilogram (kilo)	Metric	2.2046 pounds.
Kilometer	do	0.621376 mile.
Klafter	Russia	216 cubic feet.
Koku	Japan	4.9629 bushels.
Korree	Russia	3.5 bushels.
Kwan	Japan	8.28 pounds.
Last	Belgium and Holland	85.134 bushels.
Do	England (dry malt)	82.52 bushels.
Do	Germany	2 metric tons (4,480 lbs.).
Do	Prussia	112.29 bushels.
Do	Russian Poland	11¼ bushels.
Do	Spain (salt)	4,760 pounds.
League (land)	Paraguay	4,633 acres.
Li	China	2,115 feet.
Libra (pound)	Argentine Republic	1.0127 pounds.
Do	Central America	1.043 pounds.
Do	Chile	1.014 pounds.
Do	Cuba	1.0161 pounds.
Do	Mexico	1.01465 pounds.
Do	Peru	1.0143 pounds.
Do	Portugal	1.011 pounds.
Do	Spain	1.0144 pounds.
Do	Uruguay	1.0143 pounds.
Do	Venezuela	1.0161 pounds.
Liter	Metric	1.0567 quarts.
Livre (pound)	Greece	1.1 pounds.
Do	Guiana	1.0791 pounds.
Load	England (timber)	Square, 50 cubic feet; unhewn, 40 cubic feet; inch planks, 600 superficial feet.
Manzana	Costa Rica	1⅘ acres.
Do	Nicaragua and Salvador	1.727 acres.
Marc	Bolivia	0.507 pound.
Maund	India	82⅔ pounds.
Meter	Metric	39.37 inches.
Mil	Denmark	4.68 miles.
Do	Denmark (geographical)	4.61 miles.
Milla	Nicaragua and Honduras	1.1493 miles.
Morgen	Prussia	0.63 acre.
Oke	Egypt	2.7225 pounds.
Do	Greece	2.84 pounds.
Do	Hungary	3.0817 pounds.
Do	Turkey	2.82838 pounds.
Do	Hungary and Wallachia	2.5 pints.
Pic	Egypt	21¼ inches.
Picul	Borneo and Celebes	135.64 pounds.
Do	China, Japan, and Sumatra	133⅓ pounds.
Do	Java	135.1 pounds.
Do	Philippine Islands	137.9 pounds.
Pie	Argentine Republic	0.9478 foot.
Do	Spain	0.91407 foot.
Pik	Turkey	27 9 inches.
Pood	Russia	36.112 pounds.
Pund (pound)	Denmark and Sweden	1.102 pounds.
Quarter	Great Britain	8 252 bushels.
Do	London (coal)	36 bushels.
Quintal	Argentine Republic	101.42 pounds.
Do	Brazil	130 06 pounds.

Foreign weights and measures, with American equivalents—Continued.

Denominations.	Where used.	American equivalents.
Quintal	Castile,[a] Chile, Mexico, and Peru	101.41 pounds.
Do	Greece	123.2 pounds.
Do	Newfoundland (fish)	112 pounds.
Do	Paraguay	100 pounds.
Do	Syria	125 pounds.
Do	Metric	220.46 pounds.
Rottle	Palestine	6 pounds.
Do	Syria	5¼ pounds.
Sagene	Russia	7 feet.
Salm	Malta	490 pounds.
Se	Japan	0.02451 acre.
Seer	India	1 pound 13 ounces.
Shaku	Japan	11.9305 inches.
Sho	do	1.6 quarts.
Standard (St. Petersburg)	Lumber measure	165 cubic feet.
Stone	British	14 pounds.
Suerte	Uruguay	2,700 cuadras (see cuadra).
Sun	Japan	1.193 inches.
Tael	Cochin China	590.75 grains (troy).
Tan	Japan	0.25 acre.
To	do	2 pecks.
Ton	Space measure	40 cubic feet.
Tonde (cereals)	Denmark	3.94783 bushels.
Tondeland	do	1.36 acres.
Tsubo	Japan	6 feet square.
Tsun	China	1.41 inches.
Tunna	Sweden	4.5 bushels.
Tunnland	do	1.22 acres.
Vara	Argentine Republic	34.1208 inches.
Do	Central America	32.87 inches.
Do	Chile and Peru	33.367 inches.
Do	Cuba	33.384 inches.
Do	Curaçao	33.375 inches.
Do	Mexico	33 inches.
Do	Paraguay	34 inches.
Do	Spain	0.914117 yard.
Do	Venezuela	33.384 inches.
Vedro	Russia	2.707 gallons.
Vergees	Isle of Jersey	71.1 square rods.
Verst	Russia	0.663 mile.
Vlocka	Russian Poland	41.98 acres.

[a] Although the metric weights are used officially in Spain, the Castile quintal is employed in commerce in the Peninsula and colonies, save in Catalonia; the Catalan quintal equals 91.71 pounds.

METRIC WEIGHTS AND MEASURES.

Metric weights:

Milligram ($\frac{1}{1000}$ gram) equals 0.0154 grain.
Centigram ($\frac{1}{100}$ gram) equals 0.1543 grain.
Decigram ($\frac{1}{10}$ gram) equals 1.5432 grains.
Gram equals 15.432 grains.
Decagram (10 grams) equals 0.3527 ounce.
Hectogram (100 grams) equals 3.5274 ounces.
Kilogram (1,000 grams) equals 2.2046 pounds.
Myriagram (10,000 grams) equals 22.046 pounds.
Quintal (100,000 grams) equals 220.46 pounds.
Millier or tonnea—ton (1,000,000 grams) equals 2,204.6 pounds.

Metric dry measures:

Milliliter ($\frac{1}{1000}$ liter) equals 0.061 cubic inch.
Centiliter ($\frac{1}{100}$ liter) equals 0.6102 cubic inch.
Deciliter ($\frac{1}{10}$ liter) equals 6.1022 cubic inches.
Liter equals 0.908 quart.
Decaliter (10 liters) equals 9.08 quarts.
Hectoliter (100 liters) equals 2.838 bushels.
Kiloliter (1,000 liters) equals 1.308 cubic yards.

Metric liquid measures:

Milliliter ($\frac{1}{1000}$ liter) equals 0.0388 fluid ounce.
Centiliter ($\frac{1}{100}$ liter) equals 0.338 fluid ounce.
Deciliter ($\frac{1}{10}$ liter) equals 0.845 gill.
Liter equals 1.0567 quarts.
Decaliter (10 liters) equals 2.6418 gallons.
Hectoliter (100 liters) equals 26.417 gallons.
Kiloliter (1,000 liters) equals 264.18 gallons.

Metric measures of length:

Millimeter ($\frac{1}{1000}$ meter) equals 0.0394 inch.
Centimeter ($\frac{1}{100}$ meter) equals 0.3937 inch.
Decimeter ($\frac{1}{10}$ meter) equals 3.937 inches.
Meter equals 39.37 inches.
Decameter (10 meters) equals 393.7 inches.
Hectometer (100 meters) equals 328 feet 1 inch.
Kilometer (1,000 meters) equals 0.62137 mile (3,280 feet 10 inches).
Myriameter (10,000 meters) equals 6.2137 miles.

Metric surface measures:

Centare (1 square meter) equals 1,550 square inches.
Are (100 square meters) equals 119.6 square yards.
Hectare (10,000 square meters) equals 2.471 acres.

DEPARTMENT INSTRUCTION.

WASHINGTON, *September 26, 1902.*

GENTLEMEN: The Department has been requested by a Massachusetts company to secure, through the good offices of its consular corps, information concerning the manufacture and consumption of briquetted fuel, and to facilitate consular investigation into the subject a series of interrogatories has been submitted, which is hereto appended, the replies to which will cover the information desired.

In submitting his interrogatories, the manager says:

> I believe that the data resulting from this inquiry will be a most important factor in the commercial development of certain sections of the United States, because, without doubt, the commercial greatness of this country is more largely due to the abundance of fuel than to any other one factor.

You will therefore make the necessary investigation into the briquette industry in your districts and forward, as early as practicable, the results of such investigation, which will be published in the Consular Reports.

I am, gentlemen, your obedient servant,

HERBERT H. D. PEIRCE,
Third Assistant Secretary.

The CONSULAR OFFICERS OF THE UNITED STATES
IN CERTAIN COUNTRIES.

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1. What amount of briquetted fuel is manufactured and used annually?
2. State material from which briquetted fuels are made, whether coal dust (bituminous or anthracite), lignite, or peat.
3. What is the cost of manufacture? (Including cost of raw material, labor, and interest on money invested in plant.)
4. What is the selling price?

5. State methods of manufacture—something as to the general design of briquetting machines; names and addresses of manufacturers; binding material used, if any; methods of excavating and drying peat and lignite.

6. What is the average capacity per day of the plants? Number of men required to operate the same?

7. Where are the plants located?

8. What methods, processes, or machines are patented?

9. What is the heating value in British thermal units or in comparison with average bituminous coal?

BRIQUETTES AS FUEL IN FOREIGN COUNTRIES.

AUSTRIA-HUNGARY.

TRIESTE.

While the manufacture of briquetted fuel in Austria-Hungary is of comparatively recent origin, it has had so rapid a growth that it bids fair soon to be classed among the important industries of the country. Its remarkable development is attributed to two causes, viz, the comparatively high price of fuel in some parts of the monarchy and the great abundance of waste or inferior coal in others.

Statistical data pertaining to this new industry are so far entirely wanting, and it is impossible to obtain even a fairly reliable estimate of the amount of briquetted fuel manufactured. It may be stated, however, that there is not a single province in the monarchy which does not contain at least half a dozen briquette factories, and in some localities these plants are already as common as flour mills and brickyards.

I have made inquiry of a number of manufacturers concerning the output of their plants, but have in almost every case received an evasive reply. This is only in line with the general reluctance of Austrian merchants and manufacturers to give information concerning their business to outsiders.

Trieste has only one briquette factory. It turns out about 5,000 tons of fuel annually. This amount is rather insignificant for a city of 180,000 inhabitants, but it must be remembered that briquettes are, comparatively speaking, still an innovation here, and that in southern Austria only a very small portion of the people use fuel for any other than cooking purposes.

The principal ingredient of the briquetted fuels manufactured in Austria-Hungary is coal, or rather coal dust or screenings.

In Bohemia, anthracite is mined in large quantities, and briquettes are chiefly made of the refuse of this kind of coal. In the greater portion of Hungary bituminous coal is employed in the manufacturing plants, while in Styria and Bosnia lignite is utilized. In Croatia-Slavonia, as well as in Carinthia and some other parts of this consular district where large quantities of charcoal are produced, charcoal dust has of late also been used in the manufacture of "patent" fuel.

COST OF MANUFACTURE AND PRICES.

The cost of manufacture varies greatly, according to the location of the plant and the kind of material used. Bituminous screenings are of course cheaper than anthracite, and the price of crude labor varies in the different portions of the monarchy from 30 cents to $1 and even more a day. The briquettes made in this city are of the charcoal variety and are produced at a cost of about $10 per ton. The cost of manufacture of lignite briquettes in the province of Styria is said not to exceed $4 per ton, and the owner of a plant at Fiume informs me that he produces, by a process patented by himself, briquetted fuel at about $3.50 per ton.

The selling price of lignite and bituminous briquettes ranges in this consular district from $4.50 to $6.50 per ton, while the charcoal briquettes manufactured at Trieste sell at $12 per ton.

The prices of other fuel for domestic use are as follows: Beach wood, $2 per cubic meter, or about $7 per cord; bituminous coal, from $3 to $6 per ton, according to quality; gas coke, $10 per ton; charcoal, $12 per ton.

METHODS OF MANUFACTURE.

Nearly all the methods of manufacture are of German origin, and Germany still supplies many of the machines used in Austria-Hungary.

The charcoal briquettes manufactured in this city are made in the following manner: The charcoal screenings are first ground fine, after which coal tar is added, and the mixture stirred until it has the proper consistency for pressing. The latter is then molded into egg-shaped pieces weighing, in a dry condition, from 2 to 3 ounces. These pieces are dried in kilns and in the open air.

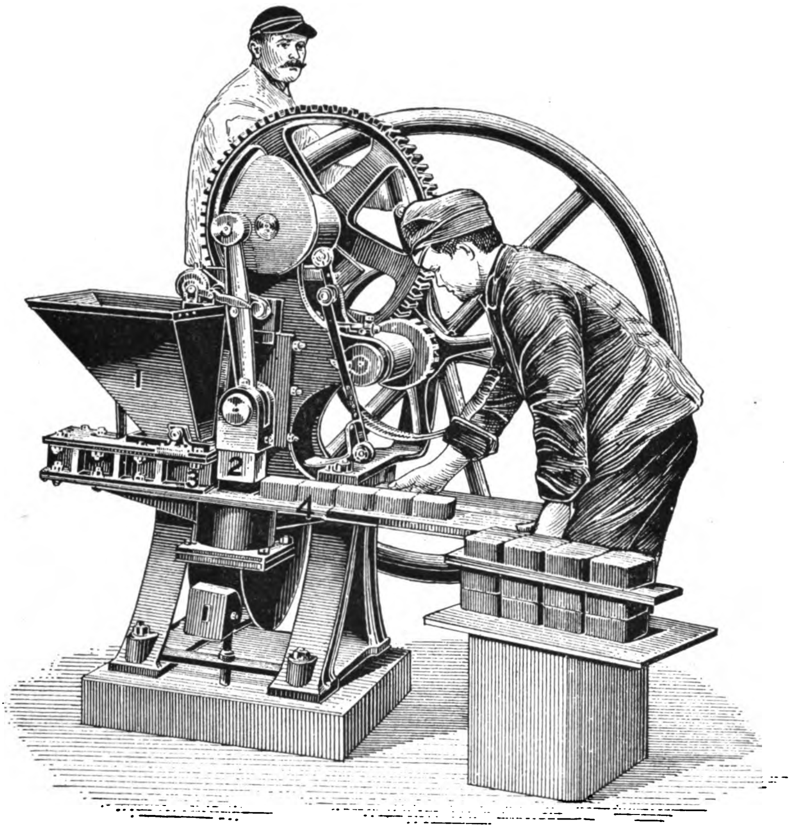
Substantially the same process is employed in the manufacture of lignite and bituminous briquettes. Lignite, however, owing to its low heating power, is seldom used without the addition of from 20 to 30 per cent of anthracite or bituminous coal. This mixture of coal is likewise ground fine, and about 10 per cent of pitch added. The composition, after having been thoroughly blended and partially dried in a kiln having a temperature of from 70° to 80° Celsius (158° to 176° F.), is pressed into bricks weighing about 10 pounds each. The product is then ready for the market.

Until recently, pitch was universally used as a bonding material. Its present high price, however, has led many manufacturers to substitute for it a composition of milk of lime, tar, and "Weisner's patent bonding material" (a solution of sulphuret of lime with free sulphurous acid, resinous substances, and lignine).

The average daily capacity of the Trieste plant, which employs from 20 to 30 men, is from 20 to 30 tons.

Eduard Wiesner & Bro., of Vienna, manufacture a hand machine with a capacity of 8,000 and a power machine with a capacity of 12,000 briquettes per day. This firm also offers to build to order machines capable of turning out upward of 100 tons of briquetted fuel a day.

The principal briquetted-fuel plants in this consular district are located at the following places: Trieste; Gorizia, Litorale; Wöllan, Styria; Trifail, Styria; Gross Ligozna, Bosnia; Dol. Tuzla, Bosnia.



The Wiesner briquette machine.

The briquette machines chiefly in use in southern Austria are manufactured by Eduard Wiesner & Bro., of Vienna, and Ganz & Co., of Budapest. All these machines, as well as the processes of manufacture, are, as far as I am able to learn, protected by patents. The Trieste manufacturer of charcoal briquettes uses a machine and process of his own invention, and has obtained patents on both.

The foregoing is an illustration of a Wiesner machine. Its working is as follows:

The funnel or hopper (1) is filled with the composition to be pressed into briquettes. A turn of the fly wheel causes the plunger (2) to rise.

The sliding apparatus (3), which in the meantime has been filled from the funnel, then passes over the mold and pours its contents into the latter. Another turn of the wheel brings the sliding apparatus back under the funnel, to be refilled. In the meantime the plunger comes down into the mold and sufficiently compresses the contents to form the briquette. The plunger and the bottom of the mold then rise simultaneously until the latter is in line with the base of the sliding apparatus and the pallet placed on the discharging table (4). While the plunger still continues to rise, the sliding apparatus, filled with material, moves over the mold, thereby pushing the finished briquette on the pallet and at the time discharging its contents into the mold, whose movable bottom has in the meantime again dropped down.

The heating value of the various kinds of coal briquettes manufactured in Austria is stated to be as follows:

	Calories.
Anthracite	5,000–6,000
Bituminous	3,500–4,000
Lignite	3,000

The assertion is freely made by the manufacturer of charcoal briquettes in this city that his product has a heating value of from 7,000 to 8,000 calories, but this assertion remains to be substantiated.

FREDK. W. HOSSFELD, *Consul.*

TRIESTE, *January 20, 1903.*

VIENNA.

Until quite recently, briquettes have constituted only a comparatively insignificant item in the household economy of the Viennese. In the course of the past year, however, various enterprising firms, chiefly German, have taken energetic steps to popularize the article, and their efforts have to a certain extent been successful. Of concerns most prominent in organizing the trade, I may mention the "Anker" and "Ilse" factories, both of which have spared neither trouble nor expense to push the sale of briquettes in Vienna and the provinces. By a system of attractive advertising and the opening of offices in the principal streets of the city, they have secured quite a large number of customers. They have, moreover, been favored in some measure by climatic influences, for during the winter there has been unusually cold weather, and a brisk business has been done.

Owing to the relatively short time that has elapsed since the introduction on an extensive scale of briquettes into the country, the statistics dealing with the quantity consumed can only be accepted as approximate. In connection with the two firms above mentioned, however, it is stated that they sell on an average about 200,000 briquettes daily, while the total sales of the other establishments amount to about the same number.

At present the trade, so far as concerns the city of Vienna and its environs, is practically in German hands. In this district, briquette making is virtually nonexistent. Of late, however, plans have been mooted for the erection of briquette works in the neighborhood of the capital, but no definite steps have been taken. In this connection it must be borne in mind that lower Austria is not a coal-producing region, the entire quantity of coal consumed here being brought from mines in Bohemia or other distant parts of the country. Its price at destination is therefore considerably increased by the cost of freight, and under these circumstances it is questionable whether briquettes could be locally manufactured at rates cheap enough to compete with the imported German product.

COST OF PLANT.

In the plans put forward for the erection of a Vienna briquette factory, it is stated that two men and five women would be necessary to serve a press with a productive capacity of 20 tons daily. On this basis, the outlay for wages would amount to, say, about $1.60 per 10 tons. Furthermore, it is asserted that to establish a factory of the size required, a capital of about $24,000 would be needed.

METHOD OF MANUFACTURE.

The briquettes on the market here are made chiefly of bituminous coal dust, and are manufactured by a process involving high pneumatic pressure. A certain quantity of anthracite briquettes is likewise sold by a firm styled Aug. Hochstöger, by whom they are imported from Germany, but the business transacted has been too insignificant to call for special remark.

PRICES.

The retail price at which the common German brown briquettes are sold in this city is $3.20 per 1,000 (about 700 pounds). The black-coal variety dealt in by the above-mentioned firm of Aug. Hochstöger is sold for 64 cents per 100 (about 180 pounds).

BINDING MATERIALS, PATENTS, ETC.

As already stated, the briquettes are manufactured by a hot process and by means of high pressure. A somewhat expensive plant is necessary to carry out the manufacture by this method on a scale large enough to prove profitable. Both the black and brown varieties are produced by an almost identical process, the binding materials consisting of coal tar, pitch, resin, and pretroleum or naphtha refuse. All of these materials, however, are said to possess the disadvantage that in course of combustion, they emit a highly unpleasant odor and generate an undue quantity of smoke.

At least a dozen different patents for briquette-making plants are filed in the archives of the Vienna Patent Office, but practically without exception they presuppose the use of the evil-smelling and smoky binding materials above mentioned. The drawbacks connected with the use of these materials, to which I have referred, are such as to hinder the briquette from gaining general popularity in this country; and, until some process is discovered by which the present objections are removed, it is to be foreseen that the population will remain true to the fuel to which it has been accustomed, and will be slow to accept the briquette as a substitute. Moreover, from inquiries made among the Viennese, I learn that for household heating purposes briquettes are considered expensive, and, so far as warmth is concerned, they can not compete with ordinary anthracite coal. In some respects they are preferred, for the reason that they are cleaner to use and can be handled more easily than common coal; but, on the other hand, the quantity of ash they leave after combustion clogs the stoves, and ultimately the disadvantage outweighs the temporary benefit. Hitherto, the Viennese, attracted by the conspicuous advertisements and notices in the press, have purchased briquettes more or less as an experiment. In most cases, however, it would appear that the trials have not proved a permanent success, for the reasons above mentioned, and gradually a return has been made to the common anthracite coal.

TRADE PROSPECTS.

Judging by investigations I have made, there is a fair prospect of lucrative trade in anthracite briquettes in this district, if they are put on the market at prices lower than those at present demanded for the German product. Furthermore, a new process doing away with the objectionable binding materials now in use would appreciably increase the chances of remunerative business.

At this juncture, the trade is practically a German monopoly; but should improvements be introduced in the manufacturing process and briquettes become generally popular, it may be taken for granted that the necessary capital for the erection of local factories will quickly be forthcoming. Austrian investors are watching the development of events, and should the briquette trade show signs of permanent vitality efforts will be made to compete successfully with foreign trade in this special branch of industry.

CARL BAILEY HURST,
Consul-General.

VIENNA, *February 28, 1903.*

PRAGUE.

There are two kinds of coal mined and consumed in this country—black and brown bituminous. The best of the former costs, retail, delivered in this city, 2.60 crowns (52 cents) per 100 kilograms (220.46 pounds) and the latter about 1.50 crowns (30 cents). The briquettes are made exclusively of brown coal.

The cost of production, including raw material, labor, and interest on the capital invested in the plant, is from 70 to 76 hellers (14 to 16 cents) per 100 kilograms (220.46 pounds).

The selling price is at present from 124 to 128 crowns ($25.17 to $25.98) per 10,000 kilograms (22,046 pounds), the retail price at the mine being 1.36 crowns ($0.276) per 100 kilograms (220.46 pounds).

In manufacturing the briquettes, the brown coal is ground in the factory, dried, and then molded into blocks by press machines, no bonding material being used.

The briquetting machinery is principally made at Buckau, near Magdeburg, Germany, by the Buckauer Maschinenfabrik. The average daily capacity of the plant is 24 carloads of 10,000 kilograms each, or 240,000 kilograms (264.5 tons).

No part of the machinery or process is patented except the apparatus for drying.

The heating value of the briquettes produced by the plant is from 5,222 to 5,843 calories.

ETHELBERT WATTS, *Consul.*

PRAGUE, *December 15, 1902.*

REICHENBERG.

The Bohemian briquette industry is of comparatively small proportion, only two factories being in present operation, viz, that of C. Melhardt, in Wesseln, near Aussig, and the Konigsberg factory, near Eger. The annual output is about 100,000 tons. The Schadowitzer Steinkolenwerke have factories at Schadowitz and Libuschin, but these have been closed for a long period for reasons not made public. A project is pending for the establishment of another press at Mantau, in southern Bohemia. Bohemian briquette manufacture appears to be an offshoot of the German industry, processes being borrowed and adapted to local conditions and to the character of the raw material—just such an application of method as it would seem must eventually be made in the United States. These processes in general have been described and the economic phases of the subject treated in the reports of Consul-General Mason, of Berlin, and repetition is unnecessary; but here in Bohemia a perfected development along one line of experiment appears to be attained that is yet novel and must prove of decided

interest to American householders, as well as to the producers of bituminous fuel of whatever character. This is the production of a briquetted fuel, dustless, more or less smokeless according to formula of composition, and of such durability and caloric value as to be a practical substitute for anthracite in the American base-burner, the hot-air furnace, and the boilers of steam plants where fuel of such a character is the first desideratum. Of equivalent importance is the fact that the basic material of this briquetted fuel is bituminous slack—the waste of soft coal,—the finished product being marketed at rates even slightly lower than those charged for lump coal of the best quality from the same mines. By the admixture of coke in varying quantities a more nearly perfect fuel is produced by the same machinery, reaching to the results attained in Herr Melhardt's "Kaumacit" briquettes—an apparent substitute for anthracite for general uses. No peat briquettes are manufactured here.

LIGNITE BRIQUETTES.

The coal fields of Bohemia produce chiefly what is locally termed "brown coal," really a lignite much resembling that found distributed through portions of the Dakotas, Montana, and other Western States. In its natural state it is of low caloric value and of imperfect combustion, producing much smoke. In prosecuting inquiries, I was informed by the Handels- und Gewerbekammer, the official chamber of commerce for this district, that brown coal is not at all suited for briquettes, on account of its low percentage of bitumen. The value of this statement appears to lie in its application, for the fact that brown coal is certainly the poorest local material for briquettes does not disturb the general proposition that all similar raw fuels are improved in utility and their caloric value and durability under combustion increased by the concentration which gives the chief value to briquettes. Thus, even the briquettes made from almost worthless waste of brown-coal mines reach a market value greater than that of the best brown lump, and while this ratio of economic value is not fully maintained when the briquette base is of the higher grades of bituminous and carbonized coal, it is approximately.

A comparatively small proportion of the Bohemian coal product is what, on account of its superiority to and hardness over the brown coal, is called "stone coal." It is also slightly brownish in color and friable, but burns freely and cleanly, and in general qualities corresponds to the average soft coal of America. The German coal of similar kind is said to be superior, and is very largely imported for household use. The word anthracite is locally applied to the best quality of imported bituminous coal, resembling the cannel coal of Pennsylvania and the lower-vein coal of Illinois and Iowa, and the current use of the word here, at least, does not imply a genuine anthracite. Official esti-

mates place the total output of coal from the northern Bohemian mines for 1902 at 18,250,000 tons, 1,500,000 tons less than in 1901, and the exports at 7,000,000 tons, 600,000 tons less than the preceding year.

The Königsberg factory above mentioned uses brown coal without admixture in manufacturing briquettes, securing an average price of about 1.25 crowns per 100 kilos ($0.25 per 220.46 pounds). This is the ordinary process, and simply by pressure converts brown coal slack and small coal into bricks[a] of a marketable fuel of concentrated caloric value as compared with the raw material.

It is to the Melhardt processes and results that attention is directed. He conducts large works for the manufacture of lighting and power gas, coke, and chemical by-products, and his experiments in the manufacture of briquettes has covered much of the ground that would otherwise have to be traversed by American imitators. His processes and machinery are protected by patents, and the machinery has been largely constructed after his own specifications. It is claimed that his products are not duplicated in Germany or elsewhere. Both processes and machinery, he affirms, can be applied with complete success to the conversion of small bituminous coal in America into clean briquettes suitable for base-burning stoves and furnaces, which could be retailed at a price approximating that of the best lump coal from the same mines. By proper admixture of coke and binding ingredients, the product can be given any desired degree of smokelessness at comparatively small increase of cost. The size and shape of the briquettes are matters of mechanism. His products are a staple on the general market, and from his demonstrated success it is easy to believe that his methods, practically applied throughout the soft-coal regions of America, would not only provide a profitable market for slack and small coal, but also give consumers a decided relief from the scarcity and high prices of anthracite. The relative cost of raw coal and briquettes made from it, at present current prices in Bohemia, can be measured from the following table, quotations being on lots of 10 tons (2,204.6 pounds to the ton):

Class.	Austrian currency.	United States currency.
	Crowns.	
1. Best Bohemian brown lump coal	100	$20.30
Dust and small coal	5	1.015
Briquettes from latter	160-180	32.00-36.54
2. Best lump stone coal	200	40.60
Dust and small coal	12	2.44
Briquettes from latter	180	36.54
	Marks.	
3. Best German stone coal	180	42.84
Dust and small coal	90	21.42
Briquettes from latter	150	35.70
4. Anthracite, imported nut size	360	85.68
Dust and small coal	100	23.80
Briquettes from latter	300	71.04

[a] Samples of which have been filed for reference in the Bureau of Foreign Commerce.

This table covers all grades of coal, local and imported, and briquettes made therefrom.

In considering the cost of manufacture, the element of labor should not be overlooked. American wages for workmen of a similar class will average double those paid in Bohemia, but the institution of improvements and economies in method might not unreasonably be expected to minimize if not entirely obliterate this difference.

COKE BRIQUETTES.

The "Kaumacit" briquette[a] manufactured by Herr Melhardt is a specialized smokeless product composed chiefly of coke and is of convenient size for stove or steam purposes. Its particular ingredients and their method of combination and manufacture are secret. It retails at a minimum price of 2.50 crowns per 100 kilos ($0.507 per 220.46 pounds). It has received severe tests at Vienna and by Engineer Haage of the boiler inspection service of Saxony. At a test made at the Berlin electric works it was also used as a mixture in varying proportions with upper Silesian coal in a search for a smoke remedy, the results not only being satisfactory as to smoke but also effecting, through more nearly perfect combustion, a greater heat efficiency from the coal itself.

Next below the "Kaumacit" in grade of Herr Melhardt's mixed specialties is a briquette known on the market as the "Dauerbrand-brikett Marke Kraft,"[a] and designed especially for German heating stoves. It is composed of certain percentages of both coke and coal, with binding material, and retails for $0.406 per 220.46 pounds. The German stove is an iron fire-pot and radiator of simple construction, surrounded by a tile structure to retain the heat. The feeding and ash doors, air tight, are closed when the fuel reaches an incandescent state, and thus all direct draft is shut off, while the gases are free to escape. For the "Kaumacit," the inventor claims that one stoking of 22 pounds will, in such a stove, retain fire for twenty-four hours, maintaining in an ordinary room a temperature of 20° C. (68° F.) with an outside temperature of −16° C. (2° F.), a result not to be obtained with less than 88 pounds of the best raw coal and four stokings. For the "Marke Kraft," the proportionate value of three to one is claimed, and in both instances the result is said to be largely due to the conditionated burning effected by the combination of materials.

Herr Melhardt offers to answer practical inquiries, which should be made in German.

S. C. McFarland, *Consul.*

Reichenberg, *February 3, 1903.*

[a] Samples of which have been filed for reference in Bureau of Foreign Commerce.

BELGIUM.

BRUSSELS.

The latest available official statistics concerning briquetted fuel in Belgium cover 1901. They show that there were in this consular district at that time 30 plants engaged in the manufacture of various kinds of briquettes, distributed as follows: Twenty-seven plants in the province of Hainaut, with a total of 60 presses and employing 1,237 workmen, and 3 plants in the province of Namur, with 10 presses and employing 83 workmen.

The amount of coal consumed in the province of Hainaut was 1,130,460 tons, from which were produced 1,236,450 tons of briquettes, valued at 23,876,000 francs ($4,608,068), or 19.31 francs ($3.726) per ton. As compared with 1900, the production shows an increase, while the average price per ton, although 4.52 francs ($0.872) less than that of the preceding year, still remained high. The following tabulated statement shows the annual production and the average price per ton of briquettes in the province of Hainaut during the last five years:

Year.	Production.	Average price per ton.	
		Belgian currency.	United States currency.
	Tons.	*Francs.*	
1897	1,030,330	12.51	$2.413
1898	1,119,180	13.40	2.586
1899	1,023,290	16.21	3.128
1900	1,091,150	23.83	4.599
1901	1,236,450	19.31	3.726

BRIQUETTE OUTPUT IN THE PROVINCE OF NAMUR.

The 3 plants in the province of Namur, which comprise a total of 10 presses, employ 83 workmen, and make coal and pitch briquettes, consumed, during the year 1901, 94,790 tons of coal in the production of 105,870 tons of briquettes, valued at 1,989,250 francs ($383,915.25), or 18.79 francs ($3.626) per ton. The output for the year shows a decrease of 2,100 tons as compared with that of 1900. The value also fell from 2,529,350 francs ($488,166.55) to 1,989,250 francs ($383,925.25), or 540,100 francs ($104,239.30).

The average selling price per ton was reduced from 23.43 francs ($4.521) to 18.79 francs ($3.626). A few small plants that do not employ pitch in the manufacture of briquettes are not incorporated in official statistics.

The following table shows the production and average price per ton for briquettes in the province of Namur during the last five years:

Year.	Production.	Total value of production.		Average price per ton.		Number of workmen.
		Belgian currency.	United States currency.	Belgian currency.	United States currency.	
	Tons.	Francs.		Francs.		
1897	47,120	589,600	$113,823.80	12.51	$2.414	45
1898	70,990	913,800	176,363.40	12.87	2.483	49
1899	89,070	1,379,750	266,260.75	15.34	2.960	53
1900	107,970	2,529,350	488,164.55	23.43	4.521	64
1901	105,870	1,989,250	383,925.25	18.79	3.625	83

Exportation of briquettes from the province of Namur during the year 1901.

Country.	Tons.	Price per ton to frontier.	
		Belgian currency.	United States currency.
		Francs.	
France	33,320	22.79	$4.398
Germany	9,115	23.17	4.471
Grand Duchy of Luxemburg	4,270	19.60	3.782
Holland	1,940	24.18	4.666
Switzerland	3,600	21.78	4.203
Other countries	12,050	20.66	3.987
Total	64,295		
Average price		22	4.246

Importation and exportation of briquettes to and from Belgium during the year 1901.

Country.	Imports.	Exports.	Country.	Imports.	Exports.
	Tons.	Tons.		Tons.	Tons.
Argentine Republic		4,350	Japan		700
Chile		2,852	Portugal		3,755
China		5,900	Russia		3,560
Kongo Free State		9,920	Spain		33,981
Egypt		2,050	Switzerland		13,697
England	152	6,975	Tunis, Africa		2,000
France	897	449,538	Turkey		4,650
Germany	15,878	44,327	United States		81,915
Grand Duchy of Luxemburg		23,987	Other countries	24	6,961
Greece		1,300			
Holland	209	9,057	Total	17,160	714,455
Italy		2,980			

COMPONENT MATERIAL.

Materials from which briquettes are made vary according to the use for which the fuel is destined. When manufactured for railroad consumption, generators, power plants, etc., about 90 per cent of bituminous coal is used, to which is added mineral pitch or coal tar. The mixture varies according to the nature of the coal employed, whether ruddy, close, or half free-burning coal. The paste contains from 13 to 14 per cent of water. When intended for domestic use, about 30 per cent of clay or marl is added. Briquettes of an inferior quality are made from a mixture of sawdust, tannery and brewery residue, peat, turf, and lignite.

COST OF MANUFACTURE.

The estimated cost of manufacture, including raw material, labor, and interest on money invested, is about 17 francs ($3.281) per ton, divided as follows: Ninety per cent coal, 8.50 francs ($1.64); 10 per cent tar, pitch, or resin, 6.50 francs ($1.25); labor and interest on money invested in plant, 2 francs ($0.386).

SELLING PRICE.

The average selling price for good quality briquettes varies, according to condition of contract and destination, from 18 francs ($3.474) to 20 francs ($3.86) per ton. For example, a recent contract was made by this Government with an establishment at Charleroi for a large quantity of briquettes, to be delivered to purchaser at works, at 18 francs ($3.474) per ton.

METHOD OF MANUFACTURE.

DESCRIPTION OF PLANT FOR SEPARATING, WASHING, AND MAKING COAL BRIQUETTES.

This plant (see illustrations on following pages) can work up 500 tons of coal in ten hours.

The work is divided as follows: To sort 300 tons of coal; to wash 150 tons; to make from 120 to 150 tons of briquettes weighing 5 kilos (11 pounds) and 50 tons of ovoid balls of 150 grams (5.289 ounces).

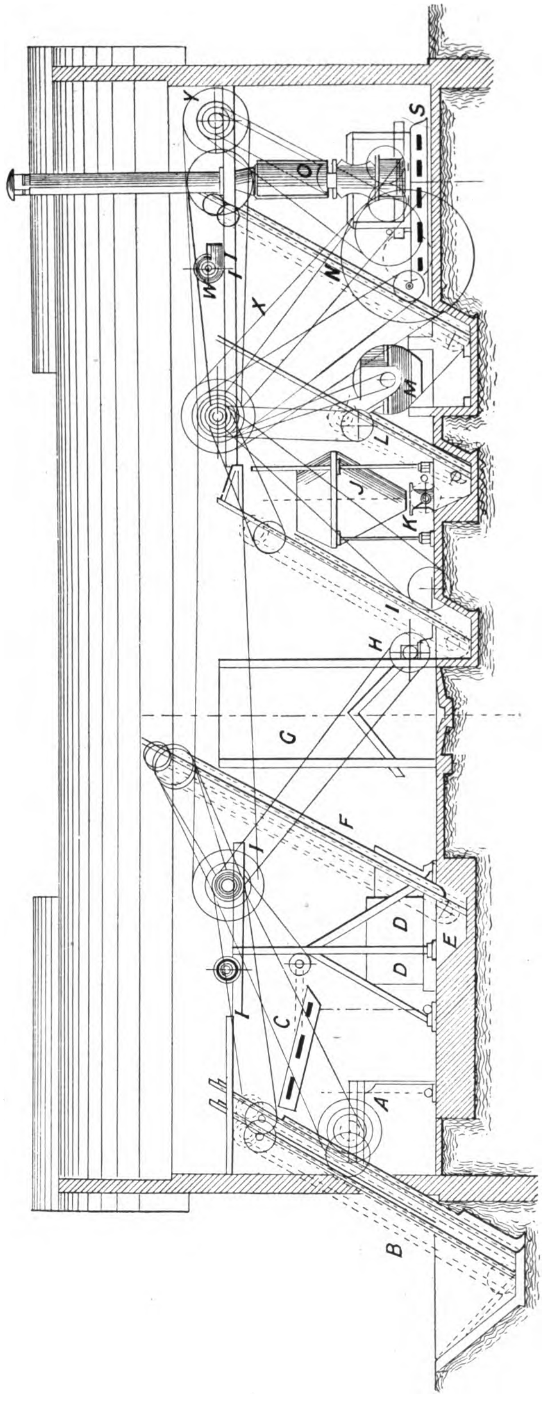
A. Separating drum. B. Endless-chain bucket. C. Oscillating table. D. Coal-washing tubs. E. Tank (or absorbing well). F. Bucket chains. G. Drainpipes. H. Forcing screw. I. Bucket chain. J. Recipient. K. Proportional distributer of pitch and coal. L. Bucket chain. M. Carr grinder. N. Bucket chain. O. Pug mill and distributer. Q. Ball press. R. Distributer. S. Briquette press. T. Cutting table. U. Steam heater. V. Steam engine. W. Ventilator. X. Beams and columns. Y. General transmission.

Coals arrive at 70 and pass through the separating drum A, which separates it into three categories, 70–40, 40–25, and 25–0.

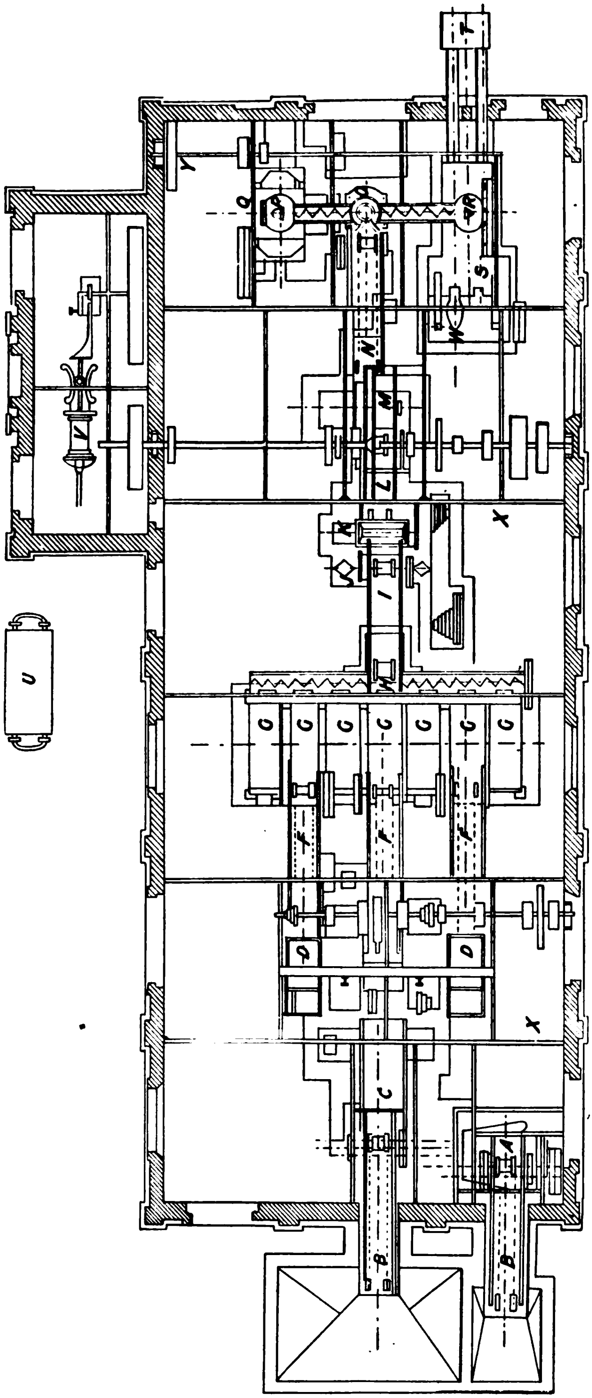
The 70–40 and 40–25 are put aside for sale. The 25–0 are passed into the tank by means of the endless-chain buckets B, from which they pass to the oscillating table or sifter C, which separates them again into three different kinds, 25–12, 12–6, and 6–0.

The 25–12 and 12–6 are carried to the washing tank D. After washing, the 25–12 and 12–6 are removed to tank E by the endless-chain buckets J, which hoist them to the draining tower G. The 6–0 is also hoisted by a movable bucket to a storing tower.

A forcing screw H, working at the foot of the towers, removes the washed coal, when sufficiently drained, from either tower and permits the reclassing of the three kinds of coal. It is easy to see that this arrangement permits the manufacture, according to the requirements



Elevation of machine.



Ensemble of machine for sorting, washing, and making briquetted fuel, working 500 tons of coal in ten hours. Price, 8,000 francs, ($1,544).

of purchaser, of three different sorts—unwashed, mixed, or thoroughly washed. The coal is then carried into the tank of the endless-chain buckets I, which hoists it into the recipient J. Under the recipient J is the proportional distributer of pitch and coal K. It is by this distributer that exact division of pitch and coal is made. The mixture is then carried to the Carr pug mill M by endless-chain buckets L. The Carr pug mill is considered to be a perfect mixing machine and at the same time an excellent grinding machine. An endless-chain bucket N then hoists the matter to the mixing machine O, where it is transformed by the action of steam into a cohesive paste.

This paste runs out through two openings placed on the right and left sides of the pug mill. Two forcing screws specially disposed for cooling the paste take it to distributer P of the balls press Q on one side, and to distributer R of the briquettes press S on the other.

The briquettes as they issue from the molds are taken to the cutting table T by means of two irons U, and separated by hand, and then, according to circumstances, are stored or delivered.

DOUBLE PRESS FOR BRIQUETTES, PRODUCING 15 TONS PER HOUR.

Among all the systems of presses for briquettes employed up to date for agglomerating coal, two types have remained in use, the press with closed molds and the press with open molds (see illustrations on next page). The latter is more generally used, as it works with washed coals containing up to 20 per cent of water and gives a big production (15 tons per hour). Its construction is simple and solid, it is easy to work, and costs practically nothing to keep in good order. The ordinary compression is 100 kilos (220 pounds) to 120 kilos (264 pounds) per square centimeter; the cohesion reaches from 65 to 70 per cent, while the railway companies in their contracts call for a cohesion of only 50 per cent.

DOUBLE PRESS FOR BALLS MAKING 5 TONS PER HOUR.

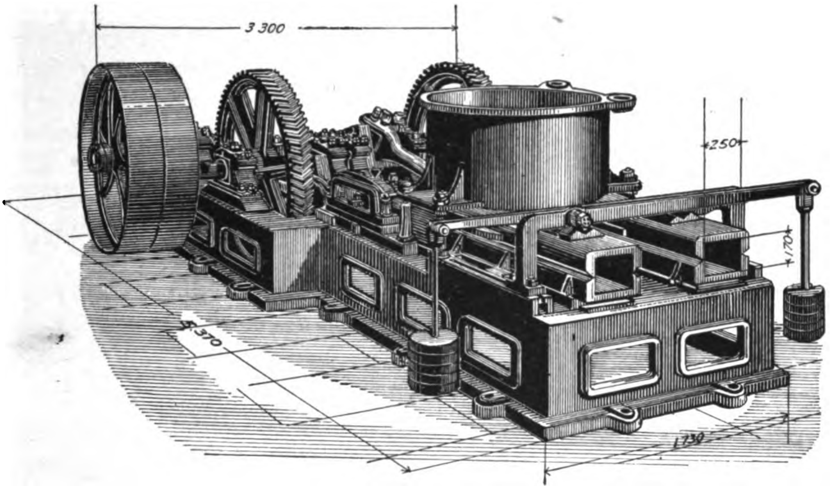
The press for ovoid balls is composed of four tangential wheels. The number of cavities in each wheel is 96 and the normal velocity of wheels is 2½ revolutions per minute. The production of such a press with two rows amounts to 5 tons per hour. The weight of balls may be changed from 140 to 180 grams (4.9 to 6.3 ounces).

The weight of this press is 10,400 kilos (22,928 pounds). Similar presses with three rows of molds are also constructed and give a production of 7½ tons per hour.

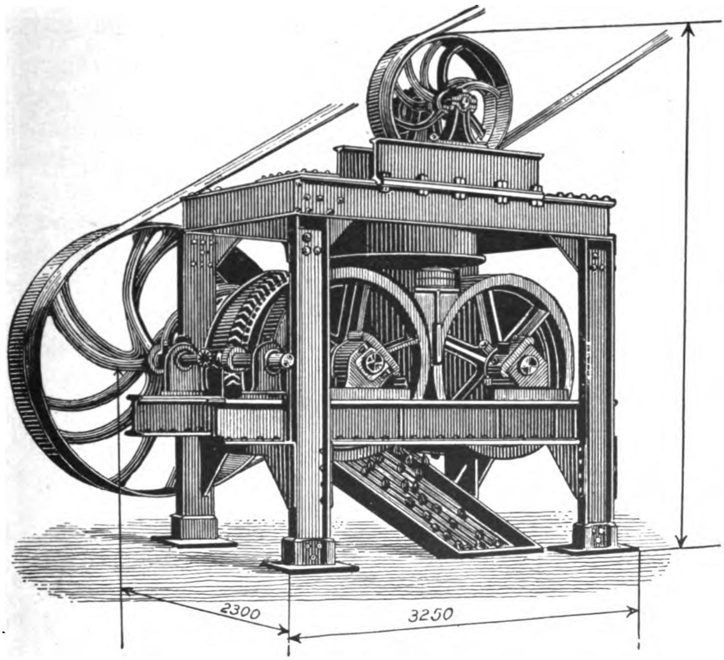
By this method, which requires very little care, a fuel is produced that is preferable to briquettes, especially for domestic stoves. There is no waste; the oval shape and great compression permits rough handling. The balls take up little room and may be thrown into ship's hold without fear of deterioration. The mixture is the same as for briquettes, viz, 5 to 10 per cent pitch, according to qualities of coal.

AVERAGE CAPACITY PER DAY OF PLANTS.

The average capacity per day of plants depends entirely upon the number of machines in use. In some plants, not more than 6,500



Double press for briquettes. Production, 15 tons per hour. Price, 8,000 francs ($1,544).



Double press for balls. Production, 5 tons per hour. Price, 8,000 francs ($1,544).

briquettes are made per day of ten hours, while in more elaborately equipped establishments, 30,000 briquettes are turned out in the same

number of hours. Plants are usually equipped as follows: Steam generators; 1 motor machine; 1 coal crusher (in some cases useless) or drier; 1 resin crusher or boiler for melting resin; resin and coal measure for measuring mixture; heating and mixing machine; mixing machine; occasionally an endless cloth for cooling, transporting, and loading the briquettes.

To work an ordinary briquette machine, the number of hands required and the wages paid per day are the following:

For—	Belgian currency.	United States currency.
	Francs.	
One foreman operating machine	5	$0.965
One stoker	4.50	.868
One overseer	4	.772
Two mixers, each 3.50 francs	7	1.351
Two carriers, each 3.50 francs	7	1.351
Three boys for loading briquettes on wagons or cars, each 2 francs	6	1.158
One boy for washing and crushing resin	2	.386
Total	35.50	6.851
Keeping in repair.		
Oils, packings, etc	5.50	1.061
Fuel, 900 kilos at 20 francs per ton	18	3.474
Total	23.50	4.535
Material.		
Washed coal dust, 25.3 tons at 8.12 francs	205.43	39.647
Pitch resin (7 per cent), 1,957 kilos at 75.75 francs	148.17	28.596
Tar (25 per cent), 699 kilos at 60 francs	41.95	8.096
Total	395.55	76.339
Grand total	454.55	87.725

LOCATION OF PLANTS.

As before stated, excepting three plants in the province of Namur, the majority of briquette manufactories in this district are located at or near Charleroi, Belgium. They are as follows:

L. Kieg-Richard, Braine-le-Comte, Hainaut.

Société Anonyme des Agglomérés réunis du bassin de Charleroi, Charleroi.

Société des Charbonnages de Sacré Madame, Charleroi.

Honillères-Unies du bassin de Charleroi, Gilly, Hainaut.

L. Waltin, Route de Philippeville, Charleroi.

Société Anonyme du Charbonnage d'Ormont, Châtelet.

Société du Charbonnage de Banbier, Châtelet.

Société Anonyme des Charbonnage d'Aiseam Cresles, Châtelinean.

Société Anonyme des Charbonnages des Trien-Kaisin, Châtelinean.

Société Anonyme des Charbonnages de Noël-sart-Culpart, Gilly.

Alb. Dehaynin & Co., Marchinne-au-Pont, Hainaut.

Société Anonyme des Charbonnages de Monccean-Fontaine et du Martinet, Moncean-sur-Sambre.

Société Anonyme des Charbonnages de Ressaix, Ressaix.

Société Anonyme des Charbonnages de Ham-sur-Sambre, et Monstier, Ham-sur-Sambre, Namur.

Stassin & Co., Auvelais Namur.

The above plants are the most important in this district.

HEATING VALUE.

The heating value of briquettes depends entirely upon their component parts. Briquettes of 90 per cent coal mixed with tar or pitch have a heating power about 10 per cent greater than the coal from which they are made. The calorific value per briquette is estimated at 7,500 calories, or in British thermol anits, 30,000.

The pitch employed in briquetted fuel in this country is chiefly imported from England.

The leading makers of briquette machines in this district are: Joseph Legrand, at Brussels; A. Robert (specialist), at Gilly; Allard Frères, at Châtelinean, Belgium.

GEO. W. ROOSEVELT, *Consul.*

BRUSSELS, *December 12, 1902.*

CHARLEROI.

The production of briquetted fuel in the province of Hainaut was, in 1901, 1,240,000 tons of 2,205 pounds, being the output of 27 factories. The average price was 19.30 francs ($3.72) per ton. In the province of Namur, the factories produced 106,000 tons, valued at 18.80 francs ($3.62) per ton. The briquettes were principally consumed in power plants, stee' and iron foundries, and glass works producing other than window glass. Apart from the consumption within the zone of production, Antwerp receives great quantities of this fuel for steamships coaling there.

MATERIAL USED.

The briquettes are made from a mixture of coal and the residue of distilled tar, the coal containing 12 to 15 per cent of volatile matter and the tar pitch 50 to 55 per cent. In the absence of coal containing the requisite percentage of volatile matter, different kinds of coal are mixed to secure the proper volatility. The tar pitch used is, for the most part, imported from England, unsuccessful efforts having been made to procure it in the United States at a price which would meet English competition.

COST OF MANUFACTURE.

The cost of manufacture of the briquettes per ton, say 17 francs ($3.50), is distributed as follows: Ninety per cent coal dust=8.50 francs ($1.65); 10 per cent tar pitch=6.50 francs ($1.26); labor and interest on money invested in plant=2 francs ($0.39).

PRICE.

The Belgian Government recently bought a large quantity of this fuel (to be delivered to buyer at works) for 18 francs ($3.47) per ton.

The price of briquettes of good quality fluctuates between 18 francs ($3.47) and 20 francs ($3.90) per ton. At this writing it is something over 19 francs ($3.67).

METHODS OF MANUFACTURE.

There are two systems for the making of briquettes in this district, the preliminary process being the same in each case. This preliminary process consists of crushing the coal, washing it, and then drying it centrifugally, by dripping, or by heating on a platform (Tigler system). In the last two cases blowers are also used. The coal thus prepared is mixed with tar pitch, which has been previously pulverized in a Carr crusher. The whole is then reduced to dust, after which it enters a rotary mixer, where it is heated by superheated steam at 300° C. and under a pressure of 8 atmospheres. The resulting paste passes through a cooler and thence to the distributer by which the molds are fed. It is in the molds that the two systems of briquette making differ. Molds are either of the open or closed type. The open-mold method of briquette compression, stated simply, has for its elements a pipe whose cross section is, in shape and size, that of the "face" of the briquette and a piston which fits one end of the pipe or mold, the other end being open. When a sufficient amount of "paste" has been placed by the distributer between the piston and the previous briquette pressed, the piston moves forward and presses a new briquette, at the same time forcing a finished briquette from the open end of the pipe or mold. The pressure exerted by the piston in this method of briquette pressing is naturally not very great, being dependent upon the friction of completed briquettes against the walls of the mold and the length of the mold. To increase the pressure the mold is sometimes tapered from the piston to the open end. Notwithstanding the difficulty of securing a desirable pressure in this type of mold, it is the one most in use, having the counterbalancing advantage of rapid production of briquettes which the closed-mold method lacks. Open molds are generally fitted up in pairs on the Bouriez continual-motion system.

The closed-mold method consists of a revolving table with cavities in it the shape of the briquette, but greater in depth than the briquette's least dimension. These cavities, filled with the "paste" by the distributer, pass in rotation under a hydraulic press, the bricks thus formed being immediately afterwards ejected automatically.

The following firms make briquette machinery, patented and otherwise. A great many patents exist that are important in a minor way.

Ateliers de Nicolaïeff at Bouffioulx.
Ateliers de Boussu at Boussu.
Société Anonyme de Marcinelle et Couillet, at Couillet.
Ateliers de l'Est at Marchienne.
Société des Usines de Gilly (Robert), at Gilly.

The company last mentioned holds perhaps the most important place among the makers of briquette machinery, and controls the more valuable patents.

AVERAGE CAPACITY OF PLANTS.

Open molds fitted in pairs (there is generally only one pair of molds to each factory), have a capacity of from 200 to 300 tons per day of twenty-four hours; any production over 300 tons is exceptional. There is no criterion as to the number of men employed in any given plant, but the process of brickmaking with a pair of molds, it would be safe to say, requires the attention of at least 12 men.

LOCATION OF PLANTS.

The following is a partial list of the briquette-making plants in Hainaut. These plants are generally affiliated with mining companies, on account of coal supply and economy in hauling:

Charbonnages Monceau-Fontaine.
Charbonnages Monceau-Bayemont.
Charbonnages Courcelles-Nord.
Charbonnages Ressaix.
Charbonnages Marcinelle-Nord.
Charbonnages Sacré-Madame.
Charbonnages Boubier.
Charbonnages Houssu.
Charbonnages Mariemont.
Charbonnages Réunis.
Charbonnages Tamines.
Charbonnages Haldy Fréres.
Usine de Briquettes du Nord.
Usine de Briquettes Aissau-Pesle.
Uisine de Briquettes Houillères Unis.
Usine de Briquettes Trieu-Kasin.
Agglomérés Réunis du Bassin de Charleroi.
Agglomérés Réunis de Châtlineau.

HEATING VALUE.

Bricks have a heating power of about 10 per cent greater than that of the coal from which they are made. The calorific value depends naturally upon the coal used and the density of the brick. Bricks that are made from unwashed or partly washed coal have less heating power and more ash. Roughly, the calorific value per brick may be set at 7,500 calories, or, in British thermal units, 30,000. Good bricks have from 6 to 10 per cent ash and from 7 to 10 per cent volatile matter.

ALBERT H. MICHAELSON,
Consular Agent.

CHARLEROI, *November 26, 1902.*

GHENT.

Neither coal nor peat is found in this part of Belgium, nor are there any forests from which wood can be cut for fuel. The ordinary bituminous coal in its natural state is the fuel almost exclusively used. Most of this coal is mined in the Walloon district, where are also located manufactories of briquetted fuel. There are no plants in this

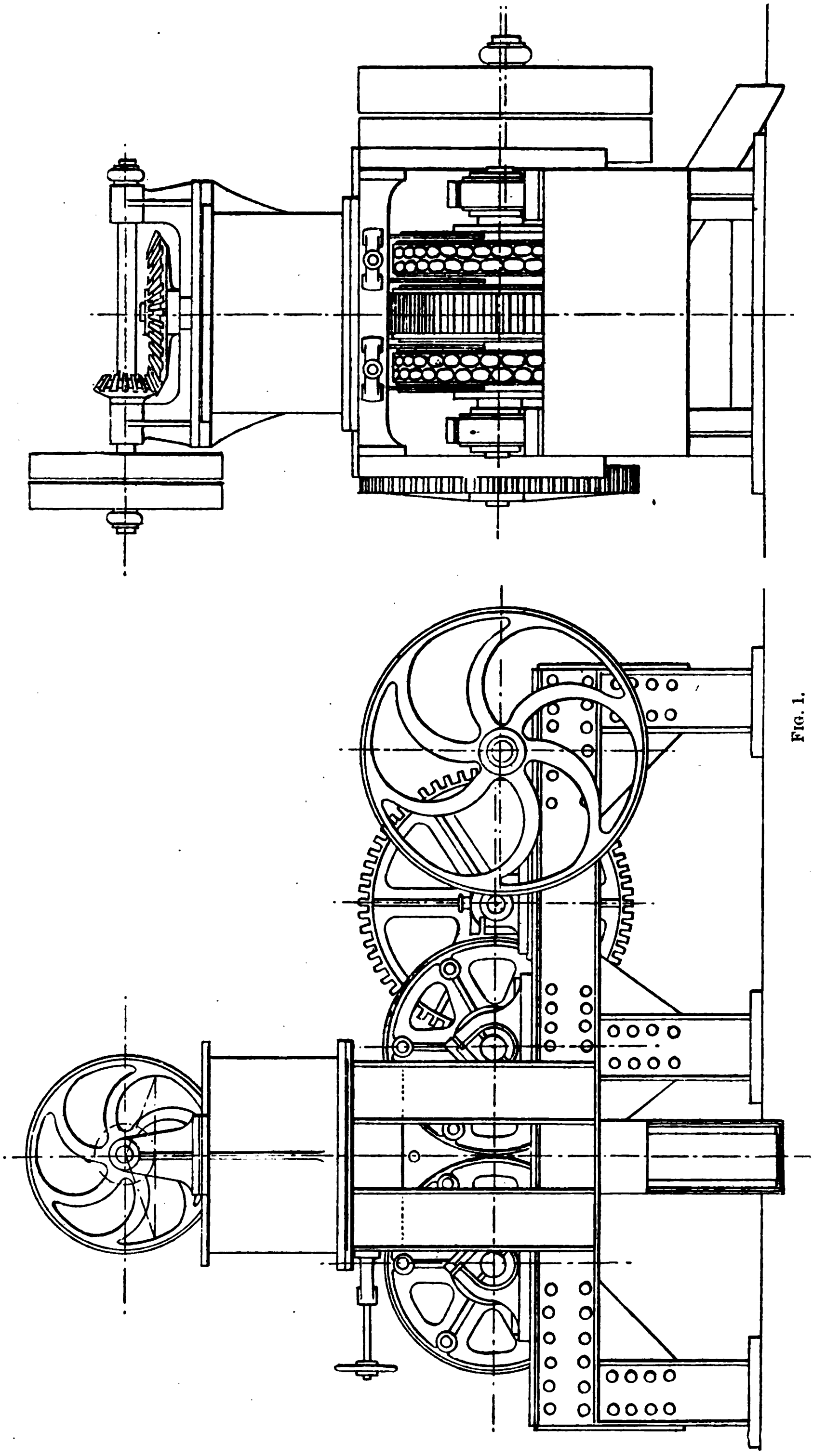


Fig. 1.

vicinity that produce either briquetting machinery or the briquettes themselves.

Briquetted fuel is offered for sale by all coal dealers, but is not generally used because it burns too slowly, except with a forced draft. It seems well adapted to the requirements of nurserymen for heating their greenhouses. It is also burned on some of the railroad locomotives and the channel steamers plying between Ostend and Dover. It is estimated that approximately 30,000 tons are consumed annually in the two Flanders. Bituminous coal ranges in price from 25 francs ($4.83) to 30 francs ($5.70) per 1,000 kilos (2,200 pounds); briquetted fuel is sold at retail from 15 francs ($2.85) to 17 francs ($3.28) per 1,000 kilos.

FRANK R. MOWRER, *Consul.*

GHENT, *December 27, 1902.*

LIEGE.

The briquetted fuel manufactured and used in Belgium amounts to about 1,500,000 tons.

The greater part is made of resin (brai) and anthracite coal dust.

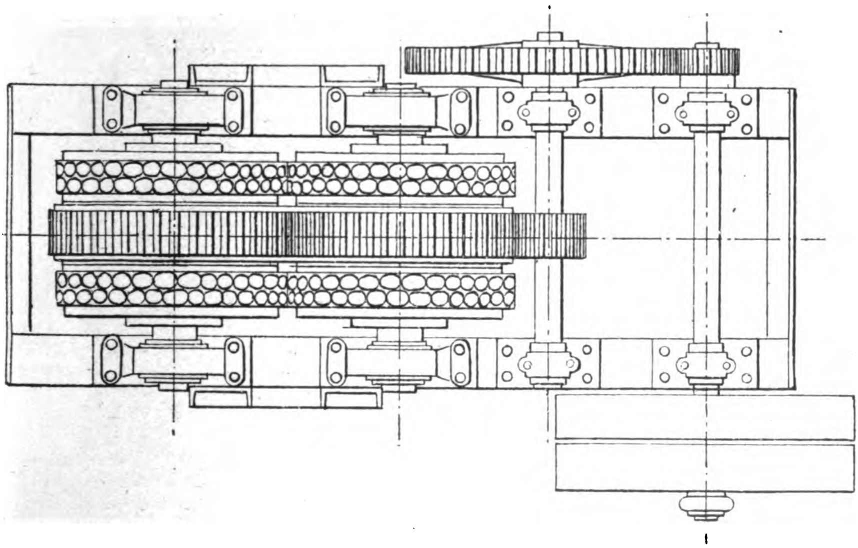


FIG. 2.

Bituminous coal gives too much smoke, and briquettes of this material are used only on board steam vessels, while anthracite coal briquettes are burned in numerous industrial plants.

The cost of manufacture is about 4 francs ($0.80) a ton.

The selling price is from 14 to 21 francs ($2.70 to $4) a ton.

In manufacturing, the coal is washed and then heated and mixed with the resin by means of mechanical mixers.

The machines used are the following:

(*a*) Press for ovoid bullets. (See figs. 1 and 2, pages 38 and 39.)

(*b*) The Couffinhal press (Presse Couffinhal) for industrial and domestic briquettes, is a closed mold with double compression. (Fig. 3.)

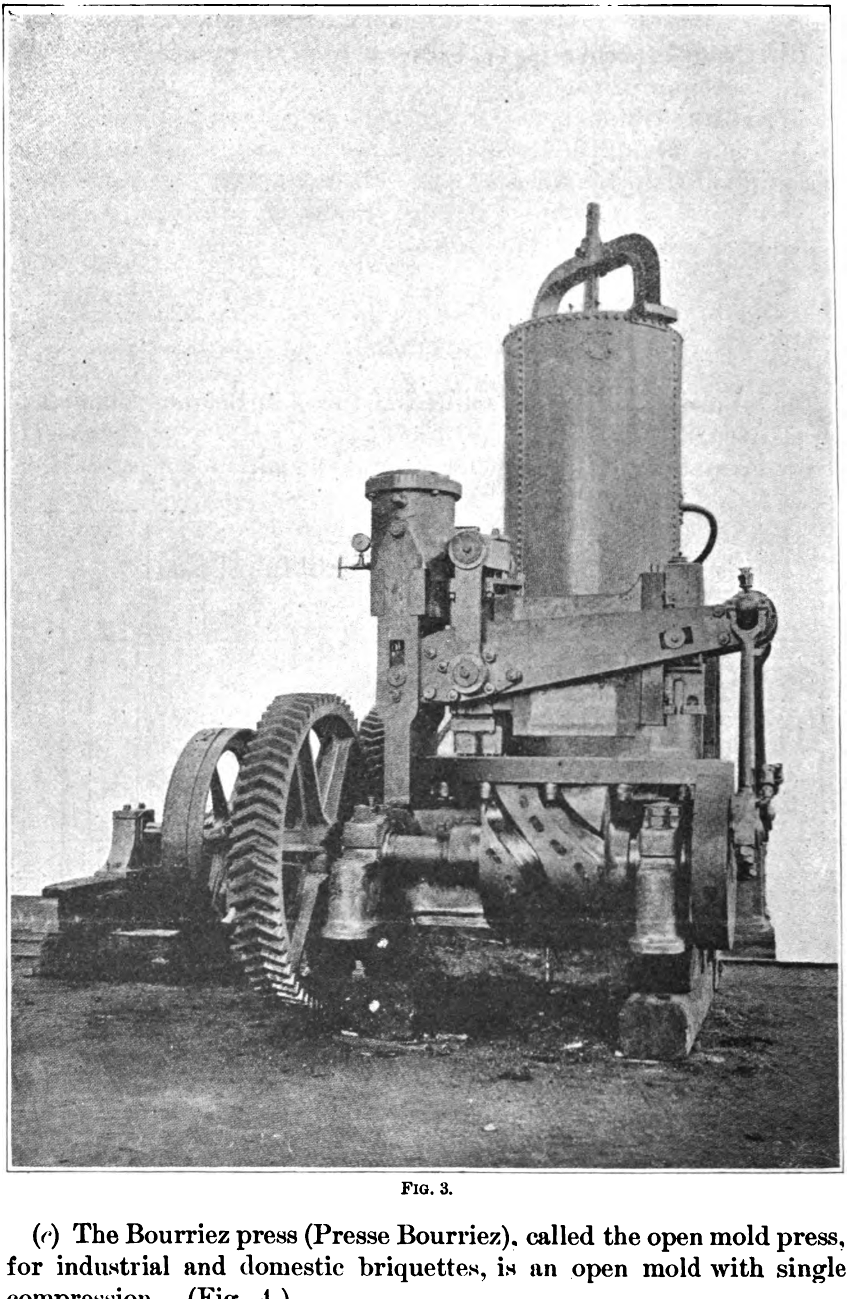


FIG. 3.

(*c*) The Bourriez press (Presse Bourriez), called the open mold press, for industrial and domestic briquettes, is an open mold with single compression. (Fig. 4.)

The ovoid bullet press in ten hours permits the manufacture of 40 to 50 tons of ovoid bullets weighing up to 160 grams (5.6 oz.) a piece.

It weighs about 11,000 kilograms (24,250.6 lbs.) and costs from 9,000 to 10,500 francs ($1,800 to $2,000) f. o. b. car, according to the different types.

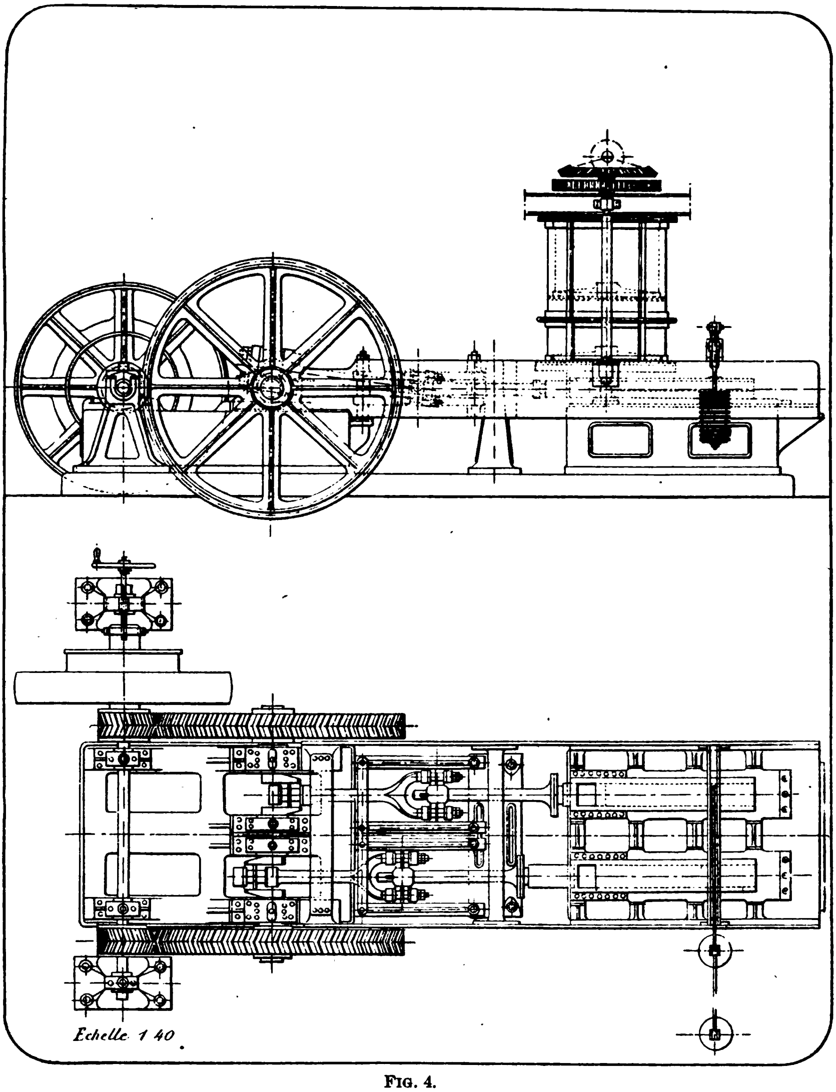


FIG. 4.

The Couffinhal press is manufactured in two different types: For 3-kilogram (6.6 lbs.) briquettes and 5-kilogram (11 lbs.) briquettes. The 3-kilogram (6.6 lbs.) type produces in ten hours 45 tons of full briquettes of 3 kilograms (6.6 lbs.) or 15 tons of perforated 1-kilogram (2.2 lbs.) briquettes.

The price for the 3-kilogram (6.6 lbs.) type is 4,000 francs ($800), and for the 1-kilogram (2.2 lbs.) 5,000 francs ($1,000).

The 5-kilogram (11 lbs.) press can produce 75 tons of full 5-kilogram (11 lbs.) briquettes in ten hours, or 30 tons of perforated briquettes of 1 kilogram (2.2 lbs.).

Arranged for 5-kilogram (11 lbs.) briquettes, this machine costs 23,000 francs ($4,500). The same arranged to make 1-kilogram (2.2 lbs.) briquettes costs 6,000 francs ($1,200) more.

The Bourriez press, with open mold, can produce 150 tons of full 5 to 10 kilogram (11 to 22 lbs.) briquettes in ten hours. The price is 20,000 francs ($4,000). The mixer and cutting table for this press cost 6,500 francs ($1,500).

The plants are generally in the vicinity of the coal mines.

No methods, processes, or machines are patented but the above named.

The briquettes contain from 12 to 18 per cent of volatile matter.

JOHN GROSS,
Vice and Deputy Consul.

LIEGE, *January 30, 1903.*

FRANCE.

MARSEILLES.

The briquette of France, or, as it is known in England, "patent fuel," has acquired an important position in this market, from which it is unlikely to be dislodged, so long as coal retains its supremacy as a generator of steam. The product of the French mines is friable by nature, and until the briquette was perfected, a large percentage of the total output of the mines represented a total loss. The manufactured fuel permits what was once largely refuse to be sold at prices running fairly even with the price of the choicest coal taken out of the domestic mines, and at the same time it possesses certain striking advantages of its own. The French Government requires the railways of the country to maintain a stock equal to their requirements for three months, and this reserve usually consists of briquettes, which are not liable to spontaneous combustion, as in the case of run-of-mine coal, and may be measured quickly and accurately with an ordinary measuring rod. Upon shipboard, these same large briquettes, weighing 16 or 18 pounds, may be stored up to the full height of the bunkers, and in the most economical manner as regards space. As the binder employed is invariably pitch, with a heating value equal to that of the coal itself, the resultant briquette has a heating value equal to that of the best lump coal of the same category. It is understood, of course, that French coal generally is inferior to the high-grade British

and American fuels sold in this market for navigation and industrial purposes, and the latter would be preferred to French fuel, either in a natural or manufactured form. As a means, however, of developing the French mining industry and of making possible the existence of important industries, the invention of the briquette holds a place of honor.

RECENT SUCCESS IN BURNING SMALL COAL DIRECT.

While the briquette is destined to continue an important factor in the French coal trade, the cost of manufacture is so great that of recent years every endeavor has been made by the railway companies and the manufacturers of boilers to hit upon some method of burning the low-grade fuel direct, and with a considerable degree of success. The Belgian railway companies were the first to adopt a definite scheme, and as far back as 1895 began to make use of coal dust, which did not cost to exceed 6 francs ($1.15) per ton. In France, the Company of the East first took up the matter, and is now burning washed small coal, which is very pure, but which nevertheless may be bought at a far lower price than run-of-the-mine coal or briquetted fuel. The Paris, Lyons and Mediterranean Railway Company, which has for years burned briquetted fuel exclusively, and owns three large factories for the treatment of small coal mined along its system, has followed suit with considerable success. In the burning of fine coal direct, the fireman is obliged to exercise much greater care, and the grate bars must be brought closer together. Without changing the fire box and by using a combination fuel, the Paris, Lyons and Mediterranean Company has succeeded in securing the same power per hour and per square yard of grate surface as was formerly obtained with high-class fuel alone. In accomplishing this result, both of these French companies employ small coal of rich quality, which tends to conglomerate in the fire. These methods have been adopted by the Paris, Lyons and Mediterranean Railway for the movement of freight, but not yet for the movement of fast passenger trains.

For general industrial purposes, two systems of burning extremely fine coal are now recognized as practicable. One of these involves the feeding of the coal, which, after all, must have a certain size, from a hopper upon a moving grate, as shown in the figure "A." The second system requires the construction within the furnace of a series of narrow shelves, upon which the coal reposes, the grate bars being erected vertically, as roughly indicated in the figure "B."[b]

These great economies are not possible on shipboard, and, granting their complete success, still leaves the briquette supreme as a means of making French fine coal available for navigation and for general domestic purposes. Under this latter head we have in France not

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[a] Page 44. [b] Page 45.

only the perforated and cylindrical brick, composed of bituminous small coal bound together with pitch, but also conglomerated anthracite fuel, sold in the form of eggs and balls, and also the "boulets" of charcoal, which are made of the dust gathered up in the holds of the vessels which transport charcoal in large quantities from Corsica to Marseilles.

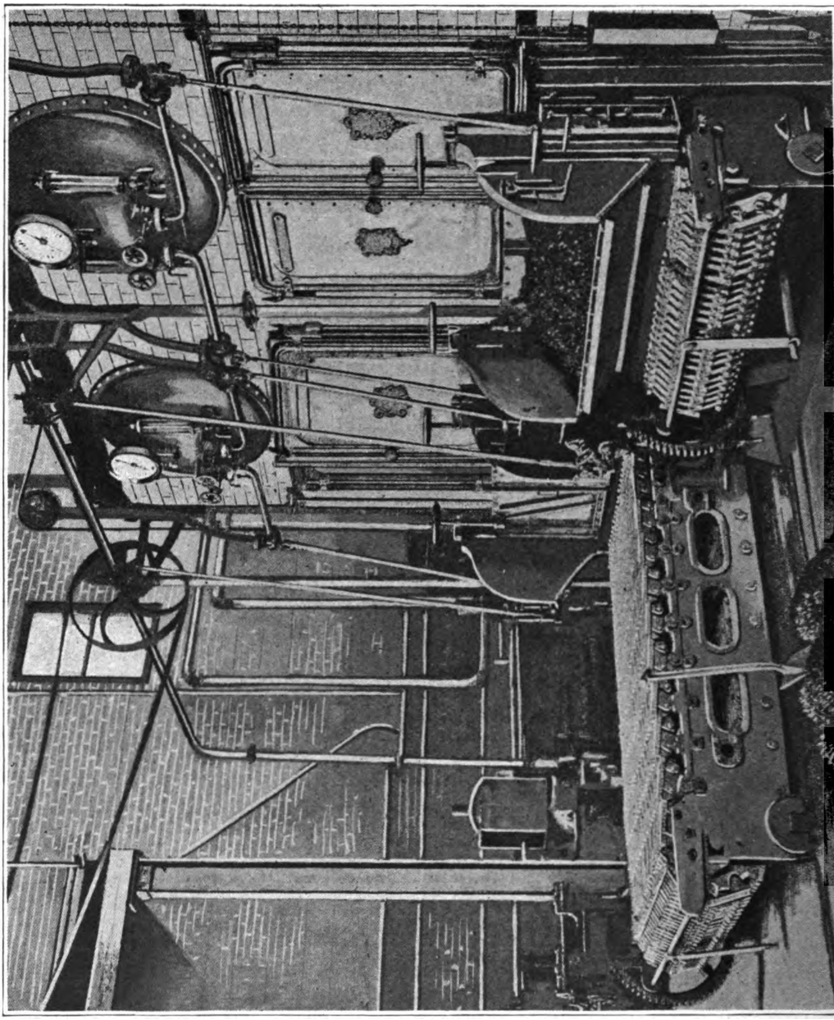

FIG. A.—Babcock & Wilcox system of firing mechanically upon an endless moving grate.

Returning to the utility of this fuel for railway purposes, the matter is summed up very satisfactorily in a letter which I have received from Mr. Noblemaire, director of the Paris, Lyons and Mediterranean Company, the largest in France, and which I translate, as follows:

Replying to your letter of November 15, I have the honor to inform you that we burn in our locomotives briquettes and large and small coal. The small coal is much

less expensive than large lump coal and the briquettes, and we therefore consume as much of it as possible. However, employed by itself, it does not permit of the development in our locomotives of all their power, and this compels us to add a proportion, more or less great, according to the service, of large coal and briquettes. Upon our system, taken as a whole, the proportion of each of these combustibles is as follows: Small coal, 65 per cent; briquettes, 20 per cent; large coal, 15 per cent. The briquette that we furnish contains 8 per cent of pitch and 92 per cent small coal. We prefer them of small dimentions when we make deliveries directly to the loco-

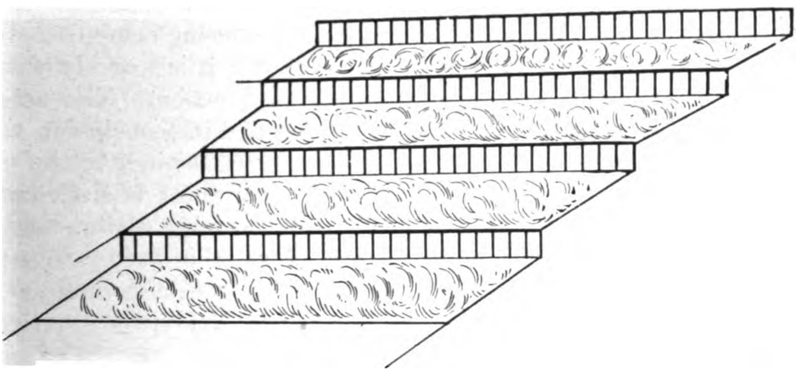

FIG. B.—Suggesting principle upon which small coal and dust may be burned direct. The fuel is fed automatically from a hopper above upon a series of shelves, the draft being secured by means of vertical grate bars.

motives and in large dimensions when we are obliged to pile them up in our stores. The dimensions and the weights of the different briquettes that we consume are very different. I indicate below the limits between which they vary:

Briquette	Length.	Width.	Thickness.	Weight.	Diameter.
	Inches.	*Inches.*	*Inches.*	*Pounds.*	*Inches.*
Prismatic	8.27–11.82	4.33–9.45	3.94–10.63	9 –26.40	....
Cylindrical	3.94–11.82	....	....	1.10–13.20	2.36–5.71

PRESENT METHODS OF CONGLOMERATING IN FRANCE.

Upon the authority of Henri de Graffigny, engineer, it may be said that the mechanical treatment of combustibles has made possible the increase in the coal production of France from 1,000,000 tons in 1820 to 34,500,000 tons in 1899. In the early years of the last century, small coal was unused. The Creusot Company used small anthracite coal as railway ballast. In 1843, Monsieur Marsais invented and constructed the first briquette machines that operated in a satisfactory manner. The product was received with immediate favor. In addition to the advantages heretofore recited, it occupied 10 per cent less space than the same weight of coal. The first attempts were made to conglomerate the small coals without any cement whatever. This method was never accepted in practice. Within the last ten years Prof. Walter Spring, of the University of Liège, conducted interesting experiments along

the same lines, and found that with a pressure of 6,000 atmospheres, and without increase of temperature, pulverized coal would take the cohesion of solid coal. It is deemed probable that if the raw material should be heated to 200° C., conglomeration could be obtained with a pressure of less than 6,000 atmospheres. These experiments have been made with oily coal, and as this is easily utilized in the manufacture of coke, it is seldom employed for the manufacture of briquettes. It may be added, moreover, that it is difficult to bring small coal up to a temperature of more than 100° without producing combustion.

Within the limits of a report of this character, it is scarcely worth while to discuss the theoretical side of the question. The actual manufacturers of French briquettes have reached the conclusion that the present method is the most economical, and that pitch is the sole binder available for practical use. Its cohesive power is sufficiently great, and it possesses in itself a high heating capacity, diminishes the amount of cinders, corrects the presence of volatile matter in poor coal, and makes possible the existence of a combustible which would otherwise separate into powder in the furnace and prove entirely useless.

NECESSARY QUALITIES OF THE PITCH.

The pitch used is the residue of the distillation of coal tar, relieved of its light oils when brought to a temperature of 150° C. and of its heavy oils at a temperature of 150° to 220°. If heated beyond the latter temperature it is relieved of its anthracenique oils, of which not more than 5 per cent should ever be retired. The dry pitch remaining in the boiler represents 65 per cent of the weight of the tar. It becomes soft at 70° C., melts between 95° and 120°, and its density is 1.19. Plunged into water at 75° C., it should be quite ductile, the threads being long and thin and 1.08 to 1.97 inches in length. One of the simplest and most exact means of appreciating the quality of the pitch is to place a morsel in the mouth. If too dry, it pulverizes under the teeth. A good quality of pitch crushes without breaking and becomes quite plastic. The price of this merchandise, most of which is imported from Great Britain, rises and falls in sympathy with that of coal. The highest quoted price since 1873 was $11.58 per ton in 1900, and it was as low as $1.79 in 1888.

All qualities of coal are susceptible of being conglomerated; but in France the half bituminous quality of fuel of from 13 to 17 per cent volatile matter is particularly employed. The fine coal of this grade coheres with difficulty when employed directly and becomes much more valuable when manufactured. Certain coals in the Franco-Belgian basin, containing not more than 12 to 14 per cent of volatile matter, also make good briquettes if employed with from 9 to 10 per cent of dry pitch. When the quality of the coal is so low as to contain not more than 10 per cent of volatile matter, the resulting briquettes

burn slowly and with difficulty. The lignites are hard to conglomerate alone, but mixed with other combustibles yield a good product. At the factory at Port de Bouc, near Marseilles, the half-rich anthracite coal of the department of Gard and Fuvean lignite (this latter in the proportion of 10 per cent) are used. The resultant briquettes have 19 per cent of volatile matter, contain 8 per cent of pitch, and have a cohesion of 60 to 70 per cent. At Aarau, Switzerland, briquettes are made of peat and anthracite with a pitch binder. These briquettes are 2.75 inches thick and 3.54 inches in diameter. They weigh 1.54 pounds each, and the production of the factory is 30,000 briquettes daily. The mass in the mold is subjected to a pressure of 30 tons.

In 1882, the gas company at Lyons began the manufacture of briquettes of coke, employing the Dupuy machine, turning out briquettes weighing 8.80 pounds each. The coke dust is mixed, without further crushing, with pitch and tar. The impurity of coke dust requires that it shall be washed, and results in a loss in weight of 20 per cent. The washing process costs 29 cents per ton of weight before the washing, and the dust itself being quoted at 96 cents, the washed product stands at $1.56 per ton. These briquettes are used to heat the furnaces, mixed with coke. Without in any manner modifying the form of the fire box 40 per cent of the coke formerly burned is supplied in the form of briquettes. The manufacture of these briquettes is very trying to the machinery, as the powder is almost as disasterous as emery, wearing away the metal with a rapidity that is almost unbelievable. The complete installation has cost the company about $8,685, not including the building. The production per day of ten hours is 6,500 briquettes, the gross weight being 28 tons. For this production there are required 1 foreman, 1 fireman, 3 laborers, 4 boys, costing per day $6.84. The general expenses per day amount to $4.52. The raw material cost is divided as follows:

For—	French currency.	United States currency.
	Francs.	
Washed dust, 25.3 tons, at 8.12 francs	205.62	$39.66
Pitch, 4,305 pounds, at 75.75 francs per ton	148.25	28.60
Tar, 1,538 pounds, at 60 francs per ton	41.95	8.10
Total		76.36

Add thereto the cost of labor and the general expenses, and the total daily expenses amount to $87.72. This makes the cost of the product $3.138 per ton. It should be added that the Dupuy press of present day type would give per day 9,500 briquettes weighing 13.20 pounds each, without any sensible increase in the labor and maintenance cost.

While briquettes are sold in a very large number of forms, the three notable types are: (1) The large square or cylindrical briquettes,

weighing about 20 pounds each, which must be broken before use; (2) the perforated rectangular briquette, weighing perhaps 1½ pounds and sold for general domestic and industrial purposes; (3) the round or egg-shaped briquettes, which have the great advantage that they are useful not only for domestic purposes, but may be shovelled easily, and are therefore generally liked for industrial purposes, although usually too expensive for such use. The standard recognized for these briquettes by the French Admiralty is the Anzin briquette, manufactured of an excellent quality of forge coal, purchased in the Anzin basin, and pitch, a combination yielding from 8,200 to 8,500 calories. The manufactured fuel for the navy is required to reach this standard, and the railway services are scarcely less exacting. The briquette for ordinary purposes being in the majority of cases manufactured from coal of the poorest and smallest grade, averages not more than 6,600 heat calories. These commercial briquettes are in large part manufactured of lignite, which is used with difficulty alone, in combination with forge coal and a relatively high percentage of pitch. The lignite represents 4,500 calories, the coal 8,500, and the pitch 7,000 and the average result in practice is 6,600. The French Admiralty and railways require that the contract briquettes shall not yield more than 6 to 8 per cent of cinders, and the average yield in general trade is from 10 to 12 per cent. Because of these requirements it is almost invariably necessary to wash the small coal before the manufacture of briquettes begins, at considerable expense.

THE COST OF MANUFACTURING BRIQUETTES.

There is a very wide difference between the cost of manufacture of the briquettes, attributable not only to the obsolete machinery employed in many cases, but to the conditions under which the coal is produced. The labor cost runs from 11 to 30 cents per ton, including the discharging of the coal and the loading of the briquettes. The wear and tear of the machinery is seldom less than 5 cents per ton, and occasionally reaches from 19.3 to 38.6 cents per ton. The briquette press appears to be a delicate machine, which must be the best of its type, in order to give satisfactory results. It may be interesting to supply in detail the expense per ton of manufacturing the briquettes in one model plant, composed of two Biétrix presses (figs. C and D)[a] producing 250 tons per day, working twenty-four hours per day:

Labor cost:	Centimes.	
Superintendent	4	$0.007
Manipulation of cars	3	.005
Discharge of pitch	5	.009
Discharge of coal	6	.012
Crushing material	17	.032
Manufacture	21	.041
Loading trucks	8	.015

[a] Pages 51 and 52.

Labor cost—Continued.	Centimes.	
Miscellaneous labor	6	$0.012
Firemen and engineers	10	.019
Total labor cost	80	.152
Supplies:		
Oil and grease	9	$0.017
Miscellaneous	7	.014
Wear and tear on machinery	10	.019
Fuel, at 6 francs per ton	31	.010
Total	57	0.11

In making up this total, labor is calculated at 60 to 77 cents per day. In another plant, composed of Rivollier presses, the total cost per ton amounts to 42 cents. This plant requires the services of 41 men, who are paid at from 60 to 65 cents per day.

The most important item in the first cost of the coal briquettes is the pitch, the price of which is twice as much in the interior as at the seaboard. Assuming as a minimum a consumption of 6 per cent of pitch at the lowest price—that is, $5.79 per ton—the cost under this head would be 34.7 cents. Add thereto the expense of labor and miscellaneous materials, estimated at 28.9 cents, and we have a total theoretical cost of 63.6 cents per ton. However, the seaboard factories usually work for the marine and employ at least 8 per cent of pitch in order to secure a satisfactory cohesion. Under these circumstances the minimum cost of manufacture and material would reach 75.2 cents. My authority, Mr. De Graffigny, furnishes other figures, which lead him to say that a maximum of $1.698 per ton for labor and materials should never be exceeded by a well-organized plant.

The plant at Flers (Nord) is considered fairly representative, and is quoted for a production of 220 tons per twenty-four hours. It includes a washing apparatus for cleansing the coal, a double Bourriez press, a 50-horsepower Corliss engine, and various other machines, tram lines, warehouses, stables, forge, ten houses, loading crane, one locomotive, four cars, and cost $135,100 in 1881, not including the land.

Generally, the coal as delivered to the pressing machines is washed, and consequently damp. When the humidity exceeds 4 to 5 per cent, it is necessary to remove the excess. The presses, which apply a pressure lasting relatively for a considerable time, such as the Rivollier, Evrard, and Bourriez, relieve the paste of the excess water, and give good results, even though the paste as it enters contains as much as 10 per cent of water. The Rivollier is the only machine which absolutely guarantees this result. The presses operating instantaneously, like the Biétrix, which is manufactured by the house of Couffinhal et Ses Fils, at St. Etienne (Loire), give excellent results, but the product requires careful drying. It is recognized as necessary and useful to

leave 1½ to 3 per cent of water in the paste when ready for the press. This quantity contributes to the plasticity of the mass during the application of the pressure. In no event does the density of the briquette equal that of solid coal. There remain always certain spaces between the component particles, and if the paste is too dry these spaces contain compressed air, which diminishes the solidity of the mass.

The cohesive power of the briquette is naturally a matter of the very highest importance. M. Wèry, engineer of the Paris, Lyons and Mediterranean Railway Company, reports the following experiments with a Biétrix machine under this head:

	Cohesion.
Briquettes containing 6 per cent of pitch:	
Pressure per square centimeter (0.1551 square inch)—	
130 kilos (286 pounds)	per cent.. 25
190 kilos (418 pounds)	do.... 46
270 kilos (594 pounds)	do.... 61
Briquettes containing 7 per cent of pitch:	
Pressure per square centimeter (0.1551 square inch)—	
130 kilos (286 pounds)	do.... 52
190 kilos (418 pounds)	do.... 70
250 kilos (550 pounds)	do.... 74

PRESSES COMMONLY USED IN FRANCE.

A properly organized plant includes:

(1) Battery of boilers.
(2) Engine.
(3) Coal crusher, or, if fine coal be supplied from the culm bank, a drier.
(4) Pitch crusher.
(5) Measurer of pitch and coal.
(6) Machine for mixing and heating the paste.
(7) Presses.
(8) Endless carrier for cooling the briquettes.

Coal crushing, washing, and drying machines are certainly familiar enough in the United States. The pitch should be crushed as finely as possible, and preferably should be melted before being mixed with the coal, and brought to the temperature chosen for the fusion. In France the pitch is melted in huge basins, with bottoms slightly inclined toward the point of discharge. The load is usually 7 tons. Frequently the pulverized pitch is mixed dry with the coal, and the mixture is then brought to the proper temperature. When the coal receives liquid pitch it is indispensable that the apparatus by which the latter is transported be heated.

The mixing mill consists of a vertical cylinder, within which a shaft operates swiftly moving paddles upon the churn principle, by which the incoming pitch and coal are beaten and mixed as they move downward toward the point of discharge. This cylinder is heated by steam. Theoretically the requirement is from 8.80 pounds to 11 pounds of steam at

100° C. to heat 1 ton of paste to the same temperature. In practice it requires as much as 110 pounds of steam per ton. In some plants superheated steam at 200° is used. It may be calculated that, if steam at 200° leaves the mixer at 100° after having left its excess of heat in the paste, it is necessary to use 110 pounds of steam per ton of paste. The dimension of the heaters should be such that the paste needs to remain in them not more than ten minutes. A little experience demonstrates whether or not the mass is thoroughly mixed. If it retains some water, which it always does if the heat be supplied by steam, it should be homogeneous, and should readily conglomerate under the pressure of the hand.

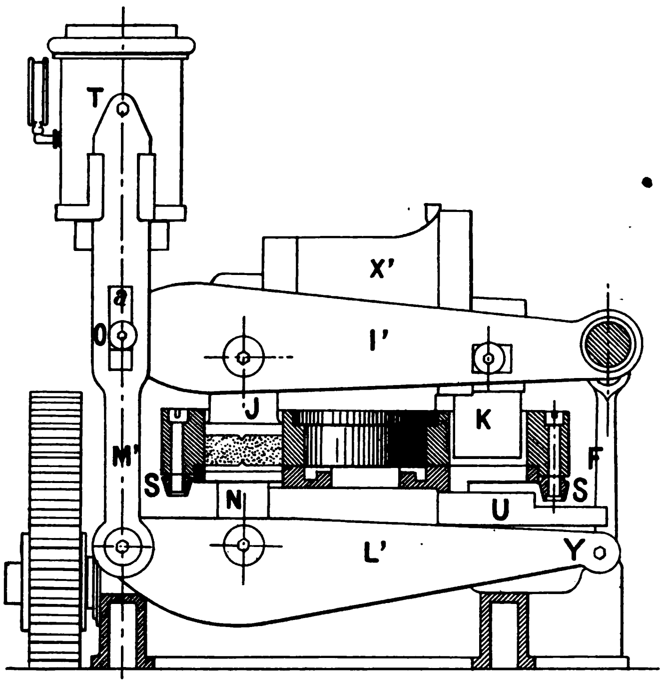

FIG. C.—Biétrix-Couffinhal press. (Elevation.)

To describe the various operations of the many presses in daily use would require much space and give no very clear understanding. At the present time, the British presses are in the ascendant, although the Biétrix machine (Figs. C and D), manufactured by Messrs. Couffinhal & Fils at St. Etienne, probably stands equally high. This latter machine presses the briquette simultaneously on its two faces, upon the principle of the nutcracker. These presses are in use at Nœux, Blanzy, Anzin, Marseilles, Rochebelle, and Rive-de-Gier. The various models produce 18, 50, 90, and 150 tons in twelve hours. The weight of the briquette is usually 13.20 pounds, but may be increased to 25 pounds. The Biétrix is a very strong press, requires little power, and

costs little for maintenance. Its successful operation requires a paste containing 1½ to 3 per cent of water and 6 to 9 per cent of pitch. The pressure varies from 196 to 264 pounds per square centimeter.

Another excellent press is that of Th. Dupuy & Fils, Paris (Fig. E). This company guarantees to supply plants producing over 100 tons of briquettes weighing 13.20 pounds each or 32 tons of 1 kilo (2.20 pounds) each, per day, for $14,275, external shed included. This

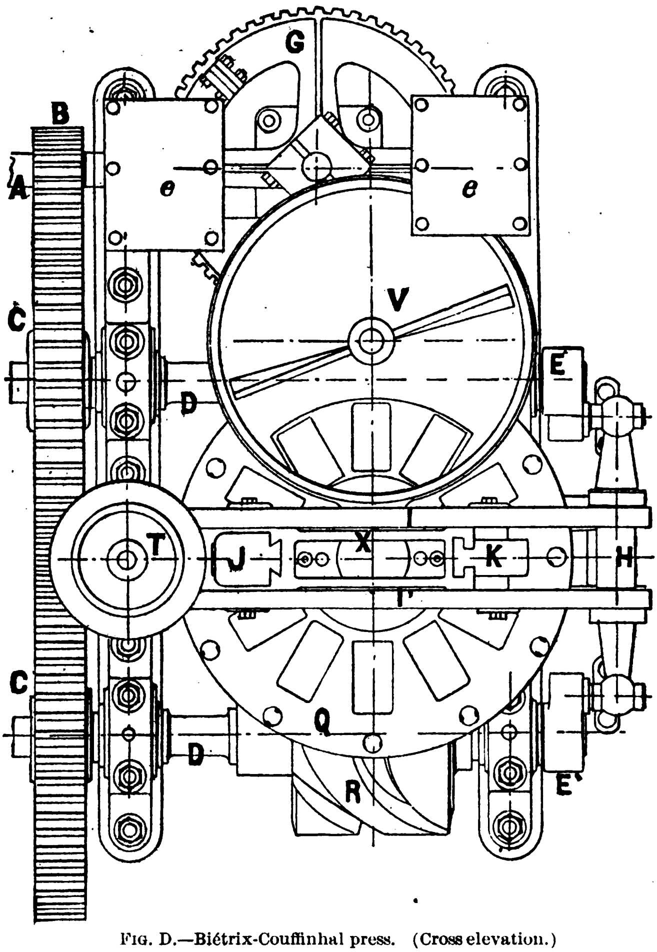

FIG. D.—Biétrix-Couffinhal press. (Cross elevation.)

machine is in use at Albi (Tarn), Courrières, and St. Eloy, and is used also for the manufacture of coke briquettes by the gas company of Lyons. The builders calculate 2 horsepower per ton of briquettes produced per hour, to which must be added 2 horsepower per hour and per ton for the several necessary operations.

The Mazelin press is manufactured by the Compagnie des Forges et Chantiers de la Mediterranée, Marseilles. It is a relatively cheap machine, but is well spoken of.

The presses for the manufacture of balls and egg-shaped fuel (Fig. F) operate upon a different principle from the others. Those manufactured by Th. Dupuy & Fils, Paris; A. Robert, of Gilly, Belgium; Fouquenberg, of Wasmes-en-Borinage, Belgium; and Zimmerman, Hanrez

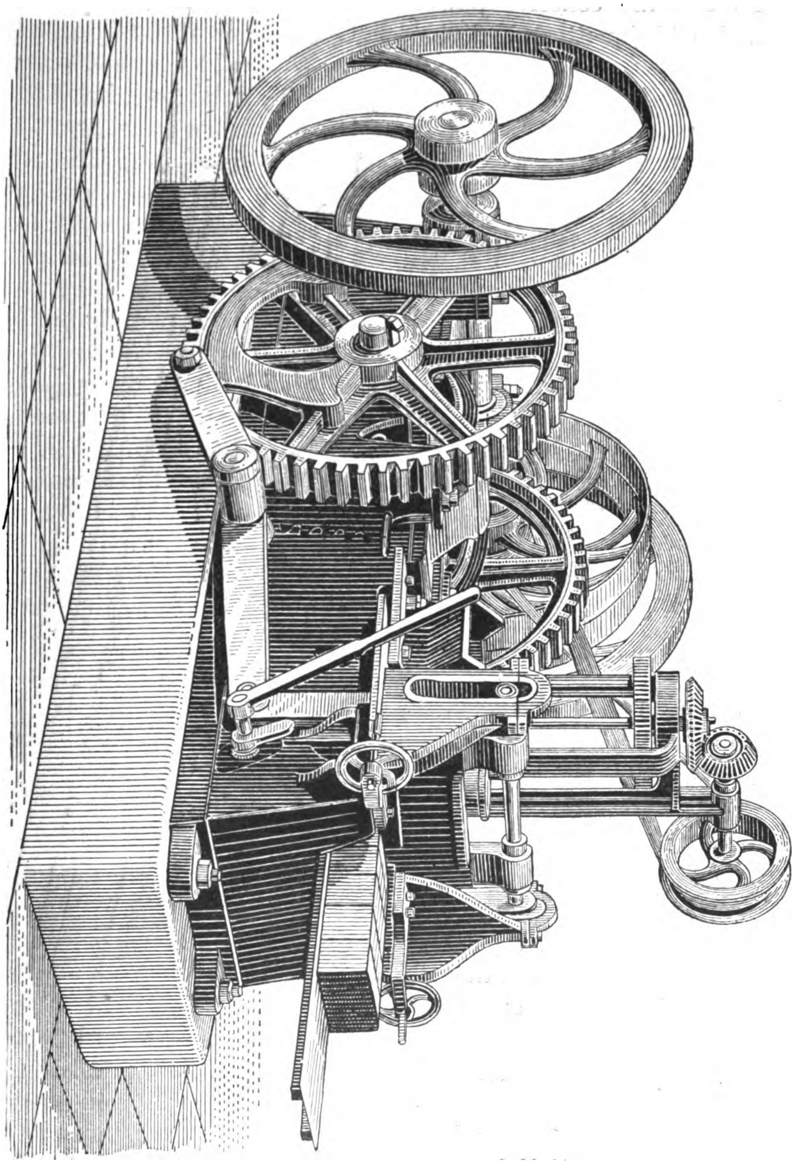

FIG. E.—Press of Dupuy & Fils.

& Co., of Monceau-sur-Sambre, Belgium, are most frequently employed. At Blanzy a Zimmerman machine produces 7 tons of balls per hour.

While the briquettes are sometimes piled directly into railway trucks,

the rule seems to be to discharge them from the press upon a long conveyor, which permits them to cool and prevents the high percentage of breakage which is certain to result if they are handled while still warm.

To test the cohesive power of the manufactured briquette, 110 pounds of briquettes are divided into 100 pieces of 1.10 pounds each, which are placed in a cylinder 36.22 inches in diameter and 39.37 inches in length. This cylinder is divided into three compartments by diametrical partitions and revolves at a speed of 25 revolutions per minute. After being charged, it is revolved for two minutes, and the contents are thereupon sifted upon a screen perforated with holes 1.12 inches square. The proportion which does not pass through this sieve indicates the degree of cohesive force, which, in the case of the French Admiralty tests, should reach 52 per cent, or if the fuel be intended for torpedo-boat use, 58 per cent. The Admiralty also requires that at 60° C. the briquettes shall not soften.

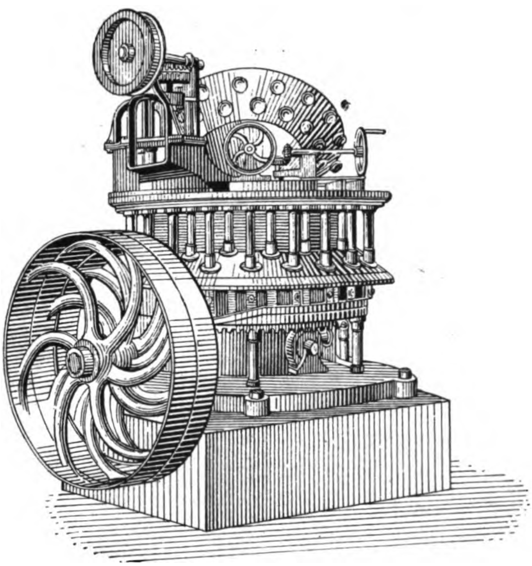

FIG. F.—Press for manufacture of balls.

PRESENT PRICES OF BRIQUETTES AND COAL.

For the purpose of establishing the relation in the consuming market between briquettes and the coal of various sizes from the same mines as those that furnish the coal used to manufacture the briquettes, I quote the retail prices of the Compagnie des Mines de la Grande Combe, delivered in Marseilles:

	Per ton.
Square briquettes:	
13 by 8 by 3 inches	$8.49
6 by 6 by 2 inches (perforated)	9.26
"Grelons gras," selected coal for kitchen	8.49
"Menus," small coal	6.36

Thus it appears that the briquettes command as much or more than the best natural coal mined by the same company.

CONCLUSIONS WITH RESPECT TO THE UNITED STATES.

My conclusion is that the manufacture of briquettes is of the utmost importance in France, where the native fuel is poor in quality and must be subjected in large part to artificial treatment; also, that the production of this fuel may be advantageously taken up in the United States. However, I believe that as a rule we have a more direct interest in studying methods of burning our small coal as such, by means of inclined fire boxes and other devices heretofore mentioned. In the development of these methods, the Babcock & Wilcox Company have taken a very prominent part, but I doubt whether they have pushed their coal-burning devices as much in the United States, where fuel is cheap, as they have in Europe. The stairway-grate idea was originally developed in Bohemia, I believe, but has been perfected by the Babcock & Wilcox Company. Certainly, every coal company could utilize its refuse in generating its own operating power with greater economy than by converting it into briquettes. The industries located in coal-mining regions could advantageously adopt the same methods. When there is a surplus of poor coal after these demands are satisfied, the conversion of the residue into briquettes may be undertaken, with assurance that if the work be scientifically carried on, the product will sell on a plane with large coal of the same grade, and will give satisfaction to the consuming public.

ROBERT P. SKINNER,
Consul-General.

MARSEILLES, *December 19, 1902.*

LYONS.

Fuel briquettes and "boulets"[a] have been used throughout France, except in the heavily wooded mountain districts, for the past fifty years. Both are thought highly of as fuel, especially the briquettes. They are more easily handled than coal and are ignited more readily. It is a widespread popular belief that they also throw out more heat. On railroad locomotives and in the marine service, they are preferred to coal, as their heat is more reliable, which enables closer calculation to be made as to the amount of steam that can be obtained. Briquettes can be preserved indefinitely without loss from exposure to the elements. Several cords of briquettes have been piled at the railroad station at Chagny for twenty years without showing signs of deterioration. The fact that they are so easily handled makes them very popular among firemen and engineers on both locomotives and steamships, but being dearer than coal they are, so far as I can learn, seldom used in manufacturing establishments.

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[a] See p. 58 for illustration.

The briquette makers in France were astonished to learn that this fuel is not manufactured to any great extent in the United States, where so much coal is used and where necessarily an exceedingly large amount of coal dust must be wasted.

In France, there are seventeen establishments for manufacturing briquettes and bullets. In the department of the Loire are located nine works, which in 1900 made 197,555 tons of this fuel. The output never declines, but on the other hand is every year characterized by a continuous increase.

Following are figures for the output of briquetted fuel in the mining districts of France for the years 1900 and 1901:

Company.	1901.[a]	1900.[b]	Company.	1901.[a]	1900.[b]
District of the Loire.			*Department of Pas-de-Calais*—Continued.		
	Tons.	Tons.		Tons.	Tons.
Mines of Roche la Molière & Firminy	20,660	17,781	Lens	68,594	76,919
Mines of the Loire	2,718	1,834	Meurchin	94,001	97,357
Mines of St. Etienne	25,450	19,200	Moeux	105,426	96,848
Mines of Ville-Bœuf	28,924	29,608	Ostricourt	53,800	52,350
Mines of Gros	10,116	17,246			
Mines of the Chazotte	43,723	31,218	Total	329,025	326,062
Mines of the Peronnière	79,410	76,143			
Mines of Rive de Gier	....	....	*Department of the Nord.*		
Mines of Ban la Faverge	2,749	4,525			
			Anzin	221,960	183,883
Total	212,750	197,555	Escarpelle	42,330	41,888
			Flines-lez-Raches	30,081	27,725
Department of Pas-de-Calais.					
			Total	294,371	253,496
Carvin	5,773	....			
Courrieres	1,431	2,588	Aggregate total	623,396	579,558

[a] Approximate figures. [b] Official figures.

It will be seen from the above statement that the production for 1901 increased 43,838 tons over 1900.

The briquetted fuel is liked because it is free from stones and clinkers and is cleaner to handle. A dealer told me that it is largely used by wealthy families. Personally, I prefer to burn briquettes in my own household because they ignite very readily, make a cheerful flame, and throw out a good heat, and because it is easier to put a briquette on the fire than a shovelful of coal. There is absolutely no dust in them, and one can handle them without getting one's fingers dirty.

At the present time, small coals bring only 10 to 10½ francs ($1.93 to $2.03) per ton, when a sale can be found; but when converted into briquettes they fetch 20 to 22 francs ($3.86 to $4.25) per ton.

The manufacture of this "patent fuel," as it is called in England, has been carried on in different parts of Europe for over half a century, and it is now a prosperous business in France, Germany, Austro-Hungary, Belgium, and Wales. Some four years ago, a citizen of Bavaria by the name of Kohlendorfer made petroleum briquettes of petroleum refuse and sold them as fuel. The process was as follows: Ten parts of soda lye and 10 parts of fatty matter, such

as tallow, were heated in a boiler. To this mixture was then added 80 parts of petroleum refuse and, later, coal dust and sawdust. A product of less solidity was obtained by the use of resin acid instead of grease. In both cases, the product contained more than 90 per cent of combustible substance and about 5 per cent of noncombustible residue.

About 600,000 tons of briquettes was annually shipped to European ports from Wales during 1898, 1899, and 1900. All the fine coal in the Welsh coal mines is utilized in making patent fuel.

METHODS OF MANUFACTURE, PRICES, ETC.

In manufacturing the briquettes, the quantity of pitch used varies with the proportion of bitumen in the coal—the greater the amount of bituminous matter the smaller the quantity of pitch. The average proportion of pitch required is from 7 to 9 per cent. After the coal has been screened at the colliery, it is reduced by a disintegrator to as fine particles as possible. The pitch is then added, and the mixture is ready for the heater. The most common way of mixing is the dry method, by which the pitch is ground up with the coal in a dry state.

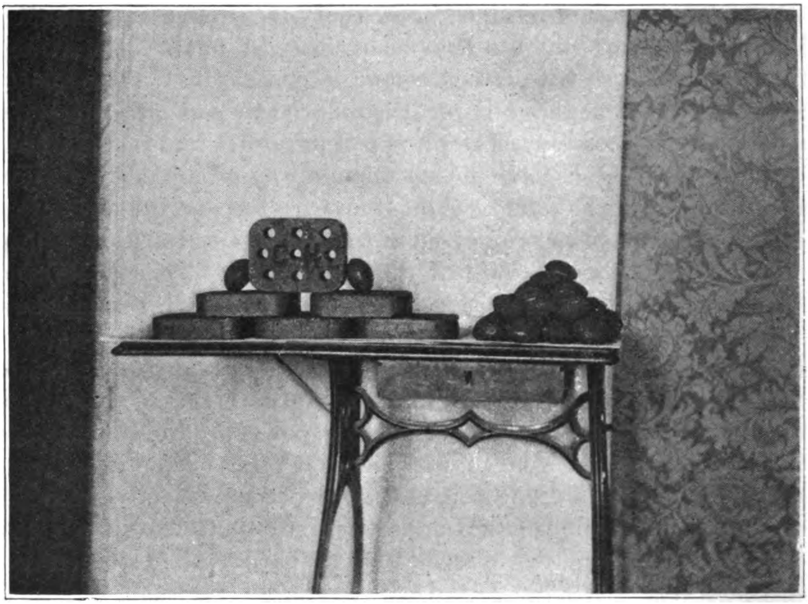
Various figures have been given in the different countries of Europe regarding the calorific power of the briquettes. Experiments made with this fuel in the Brussels gas works resulted in the production of 450 cubic meters (15,892 cubic feet) of coal gas per ton, the quality of which was superior to the ordinary coal gas. It was also demonstrated a few years ago, at the Cochet Maillard works in Paris, that a poor fuel could be raised one-third in calorific power by the addition of 8 per cent of the Vilna mixture, of which the Vilna briquettes are composed. Experiments made at Brussels have been productive of similar results. It is a common assertion in Germany that the ordinary heating power of briquettes exceeds that of hard coal by 30 per cent. Worthless coal dust when mixed with briquette composition becomes as good a gas producer as the best coal. The boiler in the Cochet Maillard works at Barmen consumed 75 to 80 kilos (165 to 175 pounds) of coal in three hours to maintain a steam pressure of 4 atmospheres. With 65 kilos (143 pounds) of anthracite dust, to which had been added 8 per cent of the briquette mixture, the same pressure was kept up three and one-half hours.

Several kinds of adhesive matter are mixed with the coal dust. Which is best could be determined only by a comparatively expert investigation. In Barmen, Germany, petroleum residue is used. In another manufactory there is utilized the distillation of shale or other mineral oil, mixed with any animal fat readily accessible, the whole saponified with soda to an emulsion, one to two hundredweight of the emulsion being employed per ton of coal dust. Ordinary brown

coal, very mediocre in heat, developing only 4,000 to 5,000 calories, will, when converted into briquettes, give 8,000 calories. This is also true in regard to the coke and coal dust found near gas works, coal mines and yards, and generally considered without value.

The bullets, of which I have spoken, are about the size and shape of a large clam. Like the briquettes, they are made of an agglomeration of 92 to 94 per cent coal dust or crushed coal with 6 or 8 per cent coal tar. Any kind of coal, anthracite or soft, may be used in their manufacture.

The cost of the coal dust varies with coal quotations. In France it is about half the price of coal, varying from 8 to 15 francs ($1.55 to $2.90) per ton. The tar costs in France from 40 to 50 francs ($7.72



Briquettes and bullets.

to $9.65) per ton, but follows the price on the English market. Brai, which is often used in the place of coal tar, is a mixture of solid carbures at an ordinary temperature and melting at 75° or 80° C.

The cost of producing briquettes varies, depending upon the equipment of the mill and upon the rate of wages paid. It may be stated as a fair estimate that six workmen can turn out 100 tons a day. The equipment for such a plant would cost in France 100,000 francs, or about $20,000.

The market price of briquettes follows the price of coal, the former being about 5 francs ($0.965) per ton higher than the latter. The retail price of briquettes is about 20 per cent higher than the wholesale price.

A number of establishments in France manufacture briquetting machinery. The most important are:

Etablissements Biétrix, Leflaive & Cie., St. Etienne.
Forges et Chantiers de la Méditerranée au Havre.
Le Petit Creusot, Chalons-sur-Saône.
Maison Voillon à Alais.
Depuy à Paris.

Briquettes might possibly be made of peat, sawdust, or lignite. In some parts of Germany they are manufactured of peat without any adhesive agency. In Sweden they are made of sawdust. Generally speaking, it is only lignite that can be profitably worked up into briquettes. This part of the business is still largely in an experimental stage. It is quite probable, however, that in the United States peat may be found, which, mixed with the residuum of petroleum, would make good fuel briquettes.

The Biétrix machine (manufactured at St. Etienne) that I saw in operation at Montceau les Mines,[a] turns out from 18,500 to 19,000 briquettes per day, the weight of each briquette being 14 pounds.

From five to eight workingmen and a foreman can produce about 100,000 kilograms, or 11,000 tons per day. But with better facilities for handling and storage, and with proximity of plant to the mine, this output could be increased.

The manufacturing houses above referred to can erect anywhere in the world a thoroughly equipped plant for the manufacture of briquettes.

REMARKS.

Briquetting machines have been in very extensive use in France for many years, the relatively high cost of coal and the economical character of the population combining to foster the development of this method of avoiding waste, and but very little, if any, slack and coal dust is lost.

The French locomotives are in great part fired with briquettes, which are also beginning to be used in factories, power stations, etc. A large part of the reserve supplies of fuel at the principal railway junctions, docks, yards, etc., consists of briquettes, which, for several reasons, are particularly adapted to this purpose. They do not deteriorate as rapidly as rough coal. They can be more neatly piled and at a steeper slope, so that a large amount may be stored on a comparatively small area. The regular form of the piles checks peculation, as the abstraction of even the smallest number of briquettes would at once become apparent. As an additional precaution against pilfering, it is the practice to whitewash the corners of the piles.

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[a] See pages 63–70 for illustrations.

There is, of course, some waste of coal in small yards, where the amount of slack and dust is too insignificant to handle with profit; but with this exception it may be said that all the coal that would otherwise be lost is utilized in the form of briquettes. And this is true even of the dust and slack of the anthracite coal imported from England and Belgium.

Within the past year or two, attention has been drawn to the briquetting of fine coke from the gas works. This has not been carried out to any extent as yet, but probably will be in the near future.

The briquetting of ores, flue dust, etc., is practiced to some extent in France, but is not a very important industry, the general metallurgical output of the country being relatively much less than elsewhere.

The machinery employed consists chiefly of apparatus for mixing the materials, of presses, of a drying plant, and of the necessary transporting and handling facilities.

I am told that French briquette makers do not look with favor upon machinery in which the mixers are combined with the press, but prefer separate machines. With this exception, it is said, the differences between the plant used here and that furnished by American builders of briquetting machinery is only in matters of detail.

Some two years ago a careful comparison was made, I am told, between American and French briquetting machinery, with a view to purchase by a large French concern. There appeared to be no very great difference between the two, and the American machinery would probably have been ordered had not a general slump in orders for briquettes resulted in a putting off of the erection of the works for which these presses were intended.

The importation into France of American briquetting machines may be possible, but it would be enormously handicapped by the French tariff, which is based upon weight, and as briquetting machinery is very heavy the duty would be onerous.

I send with this dispatch a small specimen of brai, the material used as a cohesive binder in the manufacture of briquettes at Montceau-les-Mines.[a]

JOHN C. COVERT, *Consul.*

LYONS, *January 28, 1903.*

PARIS.

There are no exact data for reckoning the amount of briquetted fuel consumed in France annually, but it is probably well over 2,000,000 tons and is increasing. From information concerning the principal

[a] Filed in the Bureau of Foreign Commerce.

factories, kindly supplied by M. Ed. Lozé, of Arras, Pas de Calais, I find the production in 1900 and 1901 was as follows:

Class.	1900.	1901.
	Tons.	*Tons.*
Naval	412,956	455,556
Railway	914,547	1,069,346
"Boulets," etc	216,175	167,249
Particulars not given	220,687	190,679
Total	1,764,364	1,882,830

This list is exclusive of the small makers, who manufacture mainly for domestic use, and of whom there are several in Paris and other cities of France. "Naval" briquettes are large, rectangular blocks, weighing from 16 to 22 pounds; "railway" are about half that size. For domestic purposes flat bricks perforated with 6 to 10 holes are used, and also "boulets"—ovoid lumps of various sizes.

Anthracite coal is not suitable for briquettes, as it requires a larger percentage of resin or tar. Briquettes made from it burn slowly and crumble into dust. A coal that is too "rich" and burns with a long flame is also unsuitable, as the briquettes give too much smoke and burn too rapidly. A mixture of anthracite and bituminous coal gives good results and does not require much tar; but the best of all is a single coal not too bituminous—what the French call a "demi-gras" coal. Lignite alone is unsatisfactory, but a demi-gras coal with 10 per cent of lignite and 8.5 per cent of tar makes a good briquette. Peat is sometimes used, mixed with anthracite and tar.

The cost of manufacture (materials, labor, and interest) is given by M. Lozé at 15 francs 10 centimes ($2.91) and by another authority at 17 francs ($3.28). The present retail price of "boulets" in Paris is 55 francs ($10.70) the ton.

There are very many types of machines used, according to the materials employed. The coal is crushed to a dust in a pulverizer, is mixed with coal tar—the best bonding material and the one most generally used—and the paste is molded in close (in the Marsais, Mazeline, and Revolier machines) or in open molds (the Evrard machine). In the Verpilleux and David & Jarlot machines, the paste is turned out in an endless block, which is sawn as it leaves the machine.

The makers of briquette machines include the following:

M. M. Biétrix, Leflaive, Nicolet & Cie., St. Etienne, Loire.
Couffinhal et ses fils, St. Etienne, Loire.
Dupuy et fils, 22 Rue des Pelets Hotels, Paris.
A. & M. Lacroix, 177 Quai de Valmy, Paris.

The factories are mostly in the Nord, Pas de Calais, Bouches du Rhone, Gard, Herault, and the basin of the Loire, but a few are in

other parts of France. The largest factory (Anzin) turns out 730 tons a day, and Grand Comebe (Gard) 700 tons a day. The number of workmen is not stated, but is proportionately small.

The number of patents connected with briquette machines is very large, and it would be impossible to give an account of them. Several of the best are, I believe, the invention of M. M. Biétrix, Leflaive Nicolet & Cie., of St. Etienne, who have already been mentioned.

No calculations exist, so far as I am aware, showing the heating value of briquettes, but it is generally stated in all the text-books to be "very little inferior to coal."

In conclusion, I may add that briquettes are used to some extent in the French navy and very largely by mail steamers. Their use for railway locomotives is increasing yearly. One railroad (the Paris, Lyons and Mediterranean) manufactures 200,000 tons a year for its own use.

JOHN K. GOWDY,
Consul-General.

PARIS, *February 17, 1903.*

ST. ETIENNE.

The idea of transforming coal dust into briquettes was first entertained and put into practice about thirty years ago by a St. Etienne engineer by the name of Marsais.

The industry has since that time made rapid progress, so that to-day nearly every hard or soft coal mine in France turns out a considerable amount of briquettes of different shapes and sizes.

The honor of constructing the first and subsequently nearly all machinery necessary for this industry may also be claimed for St. Etienne, as the important firm of Biétrix, Leflaive & Co., of this city, supplies not only all France, but also most of other European countries with briquette machines. Of these, Germany has taken a very large number and is continually ordering more.

The agglomerating machines invented and patented over all the world by Biétrix & Co. are on the system of double compression, as the accompanying illustrations indicate. (See figs. 1–5.)

DESCRIPTION OF BIÉTRIX MACHINES.

The machine is put in motion by a horizontal shaft connected with a motor which need not be of any special system. This shaft commands, by means of a pinion, cogged wheels fixed at the ends of two shafts placed symmetrically as regards the principal axis of the machine. These latter are furnished at the opposite extremities with cranks acting on the two vertical crank rods, as seen in the illustration.

These rods act in their turn on a horizontal yoke, which transmits its alternative up and down movement to two working beams placed above the table furnished with alveoli and bearing the upper molding

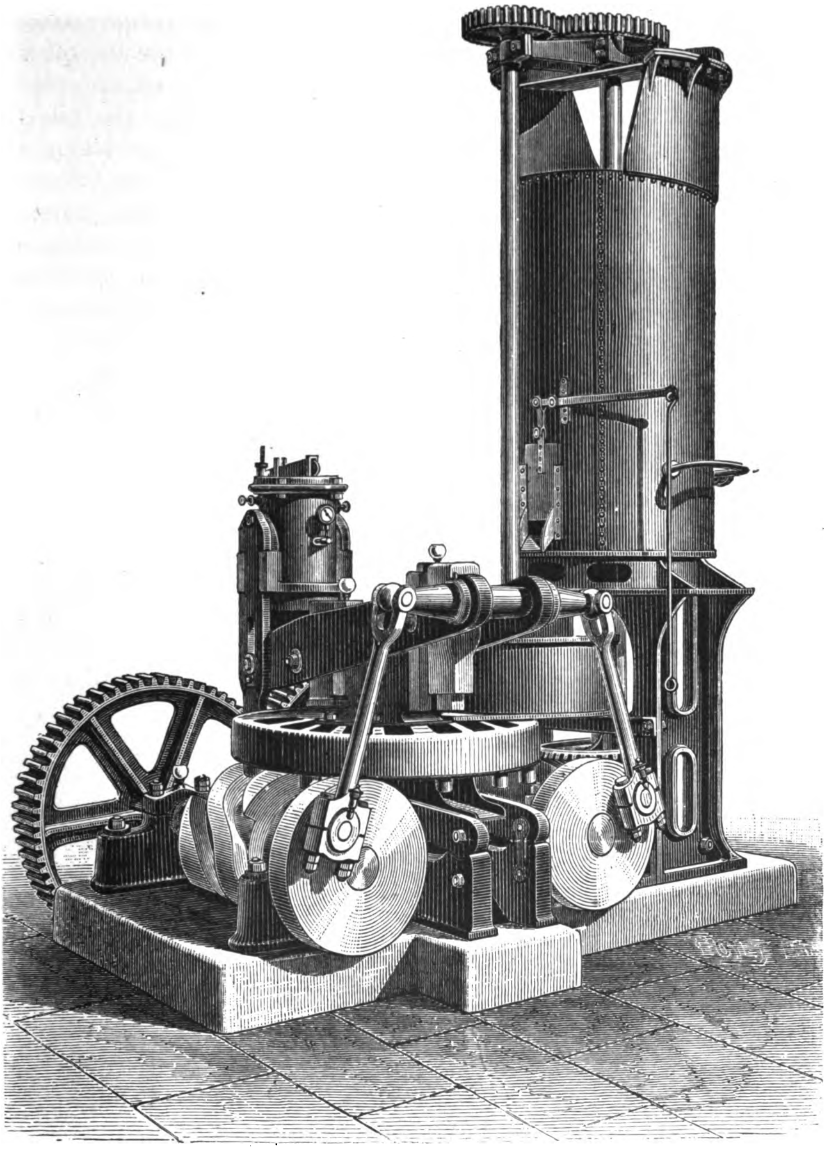


FIG. 1.—Agglomerating machine. (Complete.)

piston and the ejector piston. These last are guided by a central piece fixed to the body of the machine.

A pair of working beams similar to the preceding work the under piston beneath the table. They turn around an axis situated in front in

the middle vertical plane, passing through the yoke, and their opposite extremities are in relation with the corresponding extremities of the top beams by means of two metal uprights, on the top of which is fixed the cup of the hydraulic press regulator.

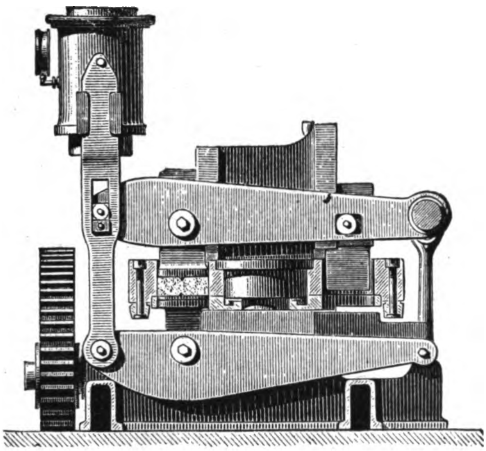


FIG. 2.

When the compression is produced by the lowering of the beams and the piston situated above the table, a moment arrives when the upper part of the briquette can not descend any more on account of the resistance presented by the lower piston and also by reason of the friction of the coal against the walls of the mold. At this instant, the lower surface being less pressed than the upper, a reaction takes place; this last becomes fixed, and the lower piston acts in its turn until the pressure becomes equal on both sides. The mechanism is very simple, reminding one of that of a nutcracker.

The posterior axis of the upper beams can be displaced in a slot

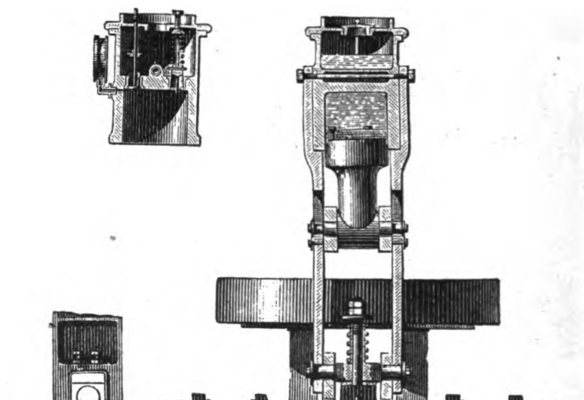


FIG. 3.

in the vertical metal posts already mentioned. It is connected with the piston of the hydraulic press cup seen in illustration No. 1. By the tension of the spring contained in this apparatus the desired amount of pressure on the briquettes is obtained with facility.

The compression is effected in three periods of time: First, the upper piston acts alone; second, the inferior piston moves up until the pressure is equal on both sides of the briquettes; third, the piston of the

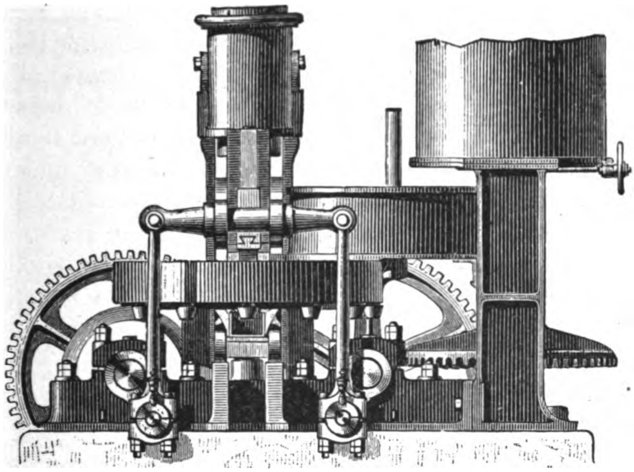


FIG. 4.

press cup enters into the hydraulic cylinder as soon as the pressure is obtained and until the point of the dead center is passed by the cranks.

The table is put into place by a drum grooved in a particular way, easily understood by examining the first illustration. The alveoli are

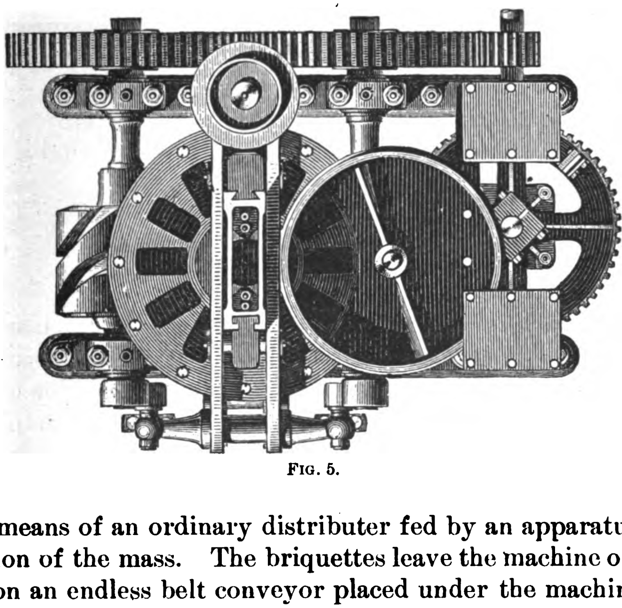


FIG. 5.

filled by means of an ordinary distributer fed by an apparatus for the preparation of the mass. The briquettes leave the machine on a swing table or on an endless belt conveyor placed under the machine.

The advantages claimed by the inventors of this double compressing machine might be briefly stated as below:

Condensation in a small volume of a strong and powerful apparatus capable of great production; considerable strength of compression on both faces of the briquettes, permitting great solidity and great homogeneity of the material; possibility of giving to the briquette, on each of its faces, forms or grooves, rendering it easy to break; advantages of being able to manufacture briquettes of a perfectly defined shape with a minimum of waste in transport and manipulation; motor power reduced to a minimum; all the organs of the machine under control before the eyes, rendering them easy to be kept in order and replaced when necessary with little loss of time; finally, the great speed of the machine, represented by 35 strokes of the piston per minute.

The above agglomerating machine is built in three sizes, and the following table gives the daily production of eleven hours and the normal weight of the briquettes:

Size.	Weight of briquettes.	Production per day.
	Kilos.	*Tons.*[a]
No. 1	3	55- 60
No. 2	5- 6	90-100
No. 3	9-10	140-160

[a] The metric ton used in this report equals 2,204.6 pounds.

SMALL-SIZED AND PERFORATED BRIQUETTES.

Certain mines make small briquettes, as they are in great demand for domestic use. The Biétrix Company also delivers machines for this purpose, that make six briquettes of nearly 2 pounds in weight at each stroke of the piston.

Perforated briquettes are consumed in large quantities in Paris. They are obtained by a simple modification of the table and the pistons. Each machine can be furnished, if necessary, with a series of tables to suit any requirements.

PREPARATION OF THE MASS.

The compression of the mass is very important in the manufacture of briquettes. It is prepared and rendered sufficiently plastic by the addition of a small quantity (6 per cent) of brai (the residue of coal tar after distillation). For a long time a steam malaxor was employed for this purpose, and because it was simple and cheap and easy to keep in order many mines used it, but when high pressure is employed, as in the Biétrix machines, it is absolutely necessary to eliminate the greatest quantity of water possible from the coal. Each time, consequently, that the coal is washed, which is generally the case in France, a drying

apparatus is required. In such case the malaxor is almost useless. The same enterprising firm responded to the necessity by constructing a special oven. (See fig. 6.)

DRYING OVEN.

This oven is circular in shape, composed of a revolving platform of cast iron, and works continuously with the agglomerating machine.

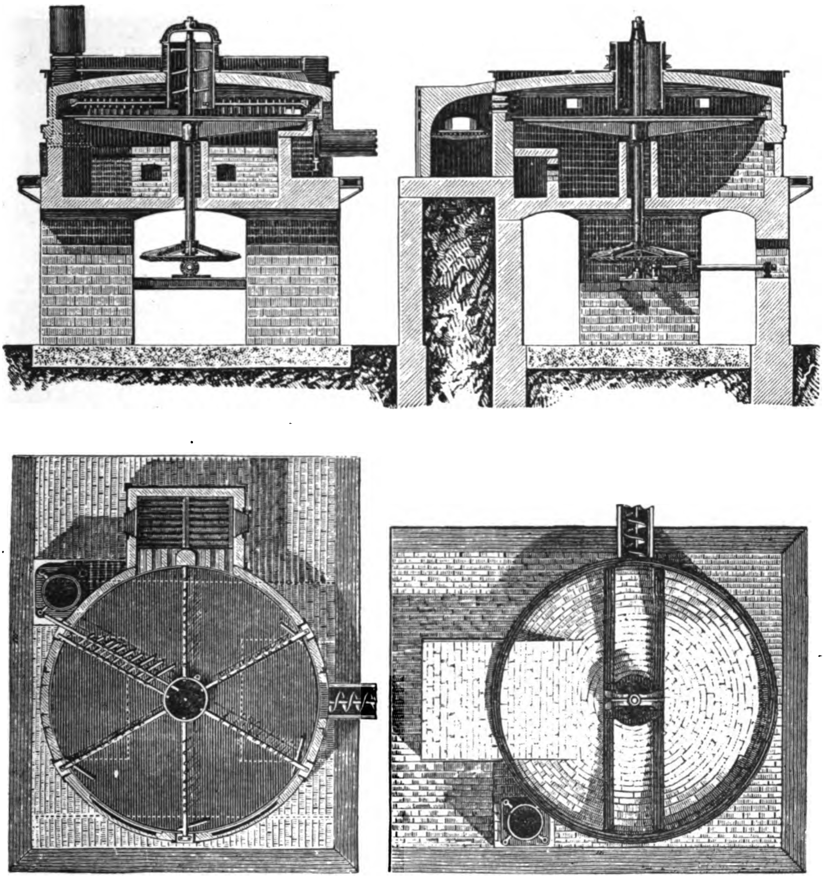


FIG. 6.—Oven with revolving table.

The platform is surrounded with masonry covered with sheet iron on which rests a dome with a passage in the center for a cylinder of cast iron with a shaft furnished with flukes. A lateral fire box produces the temperature necessary to the heating of the coal and the elimination of any excess of water. The flames after passing over the upper surface of the coal heat the dome, pass under the revolving table, and escape at the opposite end by a chimney.

Around the covering of the oven are arranged six openings. The

first four are used to introduce traverses armed with spikes which turn the material in every sense, presenting all its parts to the heat of the flame. Opposite the fifth aperture are two bars, one fixed, the other mobile, which by the aid of a small articulated shutter, like a venetian blind, bring gradually the material from the center to the

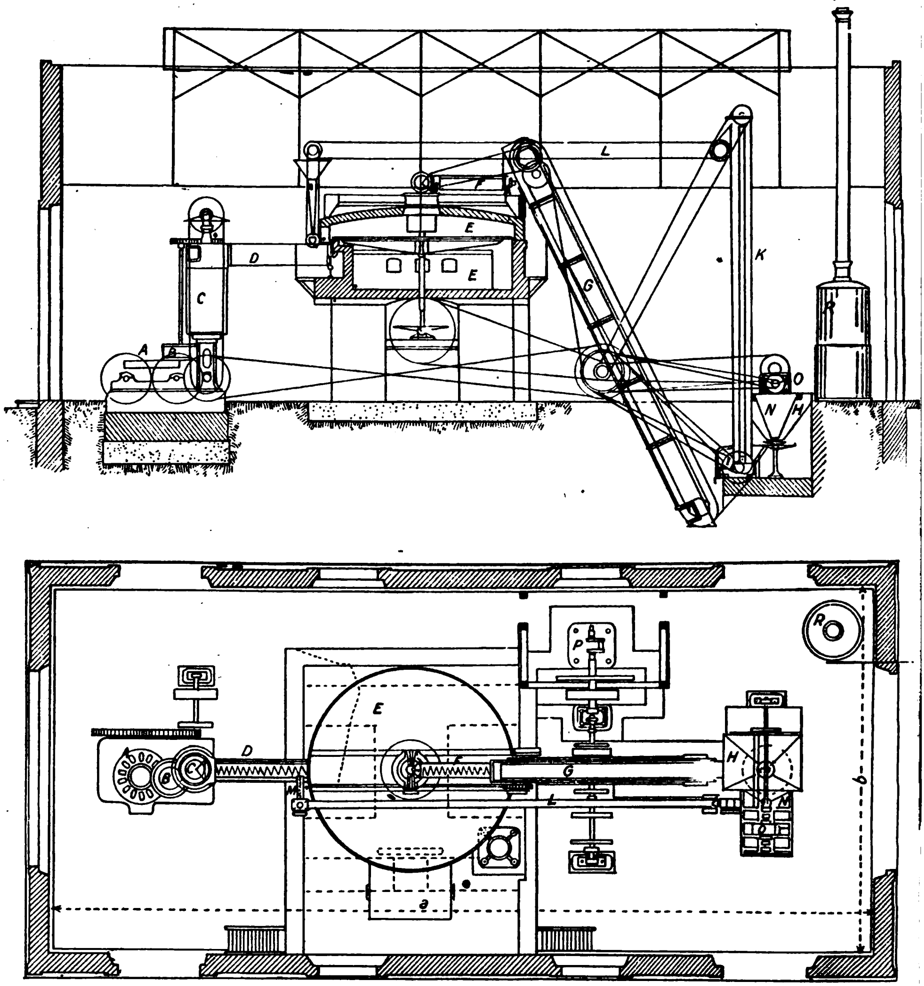


FIG. 7.—Plan of complete plant, with oven.

A. Briquette machine.	E. Drying oven.	I. Coal crusher.	N. Brai sieve.
B. Distributer.	F. Conducting screw for coal.	K. Brai elevator.	O. Brai crusher.
C. Steam malaxor.	G. Chain of buckets.	L. Brai feeder.	P. Engine.
D. Mixing screw.	H. Coal hopper.	M. Brai feeder.	R. Boiler.

circumference by turning it like the spikes. These blinds also regulate the thickness of the layer of coal, and consequently the time it ought to remain on the table. The sixth opening is used for removing the coal that is sufficiently dried.

The advantages of the drying oven are easily demonstrated.

Let us suppose the coal sent to the agglomerating works contains 10 per cent of water, which is very frequent. To reach the press in good

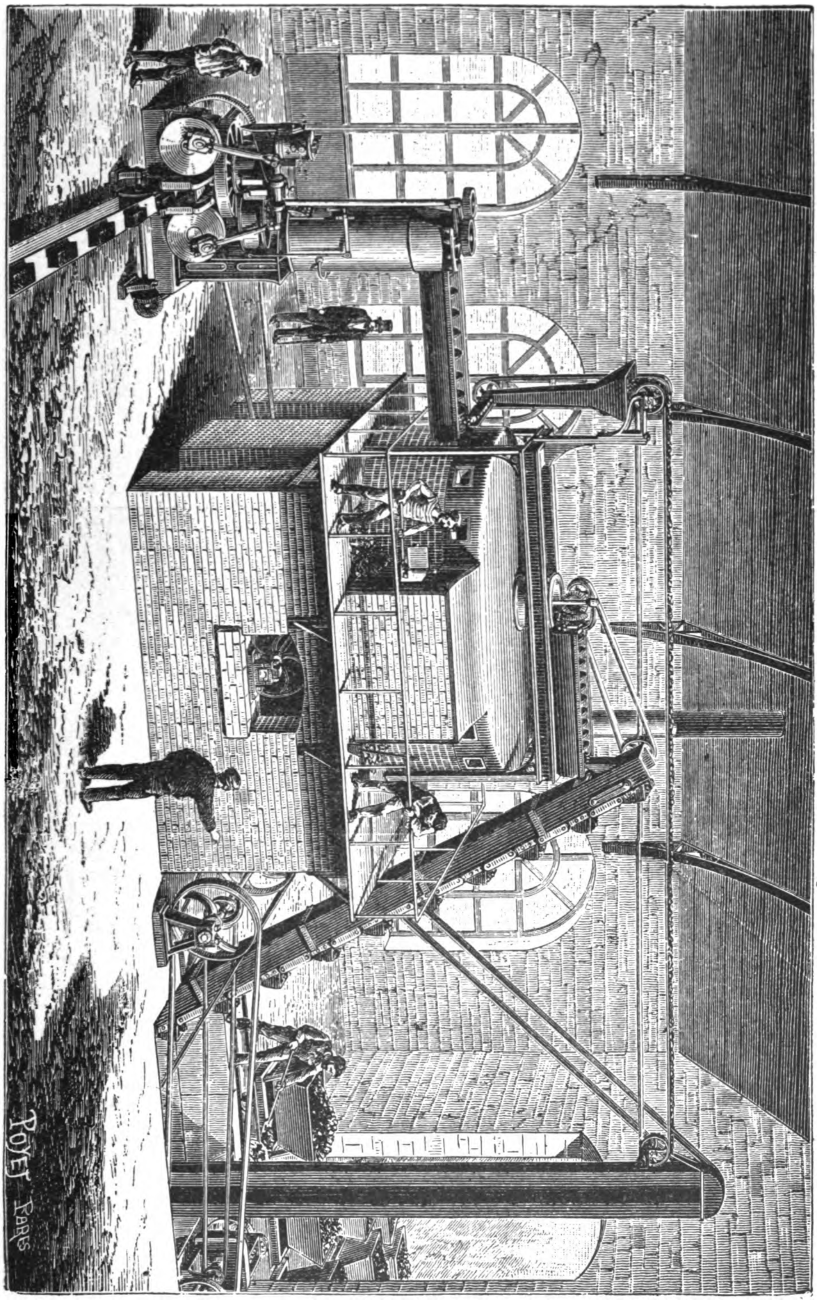


Fig. 8.—General view of plant.

condition it ought not to contain more than 3 per cent; it is necessary, consequently, to evaporate 7 kilos (15.4 pounds) of water per 100 kilos

(220.4 pounds) of coal. These 7 kilos (15.4 pounds) of water, to be evaporated at 100° C., demand, in supposing the water to be at 15° C., $7 \times (85+537)$, or 4,354 calories. If steam at 400° is brought into the malaxor, a number of calories can be disposed of per kilo which would

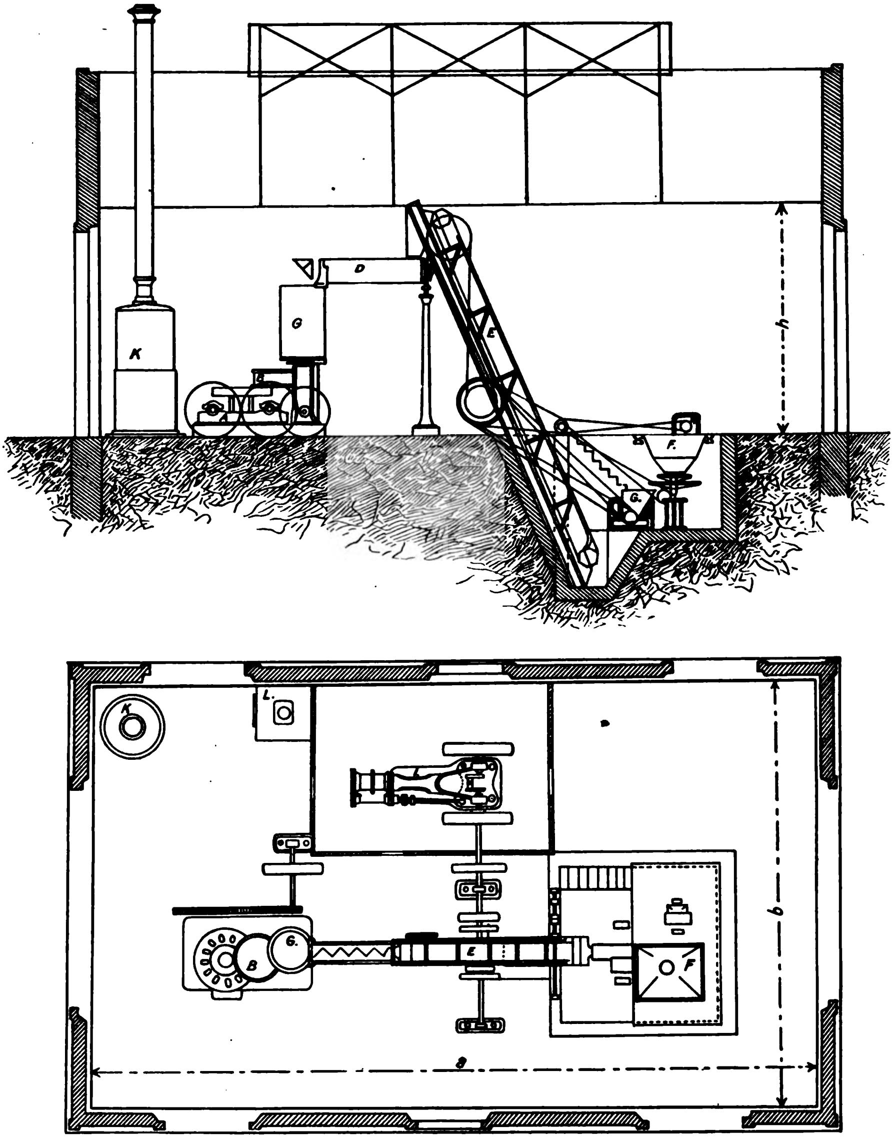


FIG. 9.—Agglomerating plant without drying oven.

attain $0.305 \times 300 = 92$, and to vaporize 7 kilos (15.4 pounds) of water should be employed $\frac{4354}{92} = 47$ kilos 500 grams (104.7 pounds) of steam at 400°.

In taking into account the excess heat, 11 or 12 kilos of coal at least

are necessary to produce these 47 kilos 500 grams (104.7 pounds) of steam, or eight or nine times more than required by the revolving platform.

Size of the buildings.

Sides.	Machines of— 3 kilos (6.6 pounds).	5 to 6 kilos (11 to 13.2 pounds).	9 to 10 kilos (19.8 to 22 pounds).
	Feet.	*Feet.*	*Feet.*
A	70	84	90
B	30	36	40
C	18	21	24

Production per day.

Machines of—	Tons.[a]
3 kilos (6.6 pounds)	60
5 to 6 kilos (11 to 13.2 pounds)	100
9 to 10 kilos (19.8 to 22 pounds)	150

It has been already said that desiccation of the coal was necessary to obtain good briquettes, but where the coal is already dry (3 per cent only of water), the drying oven is not indispensable, and in such cases the same firm (Biétrix & Co.) have arranged for works, like fig. 9, without a drying oven.

Principal types of briquettes.

Number of briquettes per stroke of piston.	Size in inches.	Weight.	Per hour.
Machine No. 1.			*Tons.*
1 briquette	9 by 4½ by 4	3 kilos (6.6 pounds).	5.5
4 briquettes	3 by 2 by 4	500 grams (1.1 pounds).	4.0
3 briquettes	4½ by 2½ by 4	700 grams (1.5 pounds).	4.5
1 briquette, perforated, 8 holes	6½ by 5 by 2	1 kilo (2.2 pounds).	1.8
1 briquette, perforated, 10 holes	6½ by 5 by 2	1 kilo (2.2 pounds).	1.8
2 briquettes, perforated, 4 holes	4½ by 4½ by 2	500 grams (1.1 pounds).	1.8
Machine No. 2.			
1 briquette, solid	10 by 6 by 4½	5 kilos (11 pounds).	9.5
2 briquettes, solid	5½ by 5½ by 4½	2 kilos 500 grams (5.5 pounds).	9.0
4 briquettes, solid	4¾ by 2½ by 4½	1 kilo (2.2 pounds).	7.5
6 briquettes, solid	3 by 2½ by 4½	650 grams (1.4 pounds).	7.0
2 briquettes, perforated, 7 holes	5¾ by 5¾ by 2	1 kilo 100 grams (2.4 pounds).	4.0
4 briquettes, perforated, 2 holes	4¾ by 2½ by 2	500 grams (1.1 pounds).	3.5
Machine No. 3.			
1 briquette, solid	12 by 6 by 4½	9 to 10 kilos (19.8 to 22 pounds).	15.0
2 briquettes, solid	7½ by 5½ by 4½	4 kilos (8.8 pounds).	12.0
3 briquettes, solid	7 by 4 by 4¾	2 kilos, 500 grams (5.5 pounds).	10.0

[a] 2,204 pounds.

Cost price of the manufacture of briquettes.

	Machines of—		
	3 kilos (6.6 pounds).	5 to 6 kilos (11 to 13.2 pounds).	9 to 10 kilos (19 to 22 pounds).
Annual expenses for 300 working days.			
Labor:			
1 foreman machinist, at $1.15 or $1.35	$345	$405	$405
1 fireman, at 77, 87, and 96 cents	231	261	288
1 fireman for oven, at 96 cents and $1.06	288	318	318
Helpers, 2, 3, and 4, at 58 cents per day	348	522	693
Raw material:			
Coal for engine and drying oven, at $2.90 per ton	1,158	1,658	2,608
Brai (5 to 6 per cent), $13.50 per ton	6,348	11,464	17,823
Sundries (repairs, oil, etc)	579	868	1,158
Total	9,297	15,496	23,293
For an annual production in tons of	17,400	28,500	44,300
Or the cost price per ton, less the coal	$0.58	$0.54	$0.53

The above cost price can not be considered as absolute, for the cost of labor and that of the brai are very variable; nevertheless the above table may constitute a basis on which to calculate.

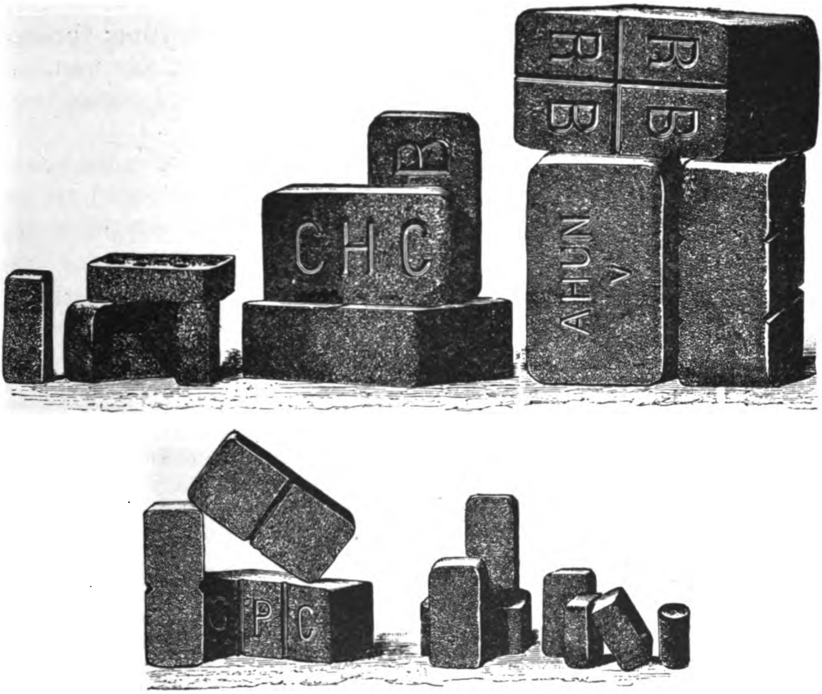
The briquettes are generally rectangular in shape, square (perforated), ovoid (very small, like hen's eggs), or cylindric, about 4 inches thick and 12 long. These latter are employed on the railways, while the other forms are appreciated for domestic use and certain industries.

Prices of the machines, ovens, and accessories.

Machine No. 1, for briquettes of 3 kilos (6.6 pounds):	
Agglomerating machine, production 50 to 55 tons	$4,825
Drying oven	1,540
Chimney of oven	115
Malaxor and screw for mixing	715
Chain of buckets and distributers	1,090
Crushers (2), one for coal the other for brai	770
Transmission of movements to above apparatus	752
Horizontal boiler	840
Engine, 30 to 35 horsepower	1,254
Sundries	445
Total	12,345
Machine No. 2, for briquettes of 5 kilos (11 pounds):	
Agglomerating machine	6,755
Drying oven	2,316
Chimney of oven	135
Malaxor and screw	1,447
Chain of buckets and distributers	1,370
Crushers (2)	965
Transmission of movement	1,196
Horizontal boiler	1,447
Engine, 60-horsepower	1,737
Sundries	600
Total	17,968

Machine No. 3, for briquettes of 10 kilos (22 pounds):

Machine	$8,685
Drying oven	2,316
Chimney of oven	135
Malaxor with screw	1,930
Chain of buckets and distributers	1,582
Crushers for coal and brai (2)	1,447
Transmission of movement	1,296
Engine, 50 to 60 horsepower	3,136
Boiler	2,277
Sundries	810
Total	23,518



Principal types of briquetts.

The heating value of the briquettes differs little from that of the coal, as the small addition of brai (6 per cent) increases it but slightly; it is consequently about the same as that of the coal, which is estimated at about 6,500 calories, or in other words, 1 kilo of coal is sufficient to vaporize 6½ liters of water.

The price of the briquettes sold to the public varies between $4.82 and $5.40 per ton.

The quantity of briquettes turned out daily in this region amounts to about 700 tons, or about 200,000 tons annually.

HILARY S. BRUNOT, *Consul.*

ST. ETIENNE, *December 8, 1902.*

PETROLEUM BRIQUETTES IN FRANCE.

The following reports by Consul Brunot, of St. Etienne, are reprinted from Consular Reports Nos. 258 and 260 (March and May, 1902).

Petroleum briquettes have been manufactured in various ways in different countries, notably in Russia, France, and the United States, as a fuel for steamships and certain industries where rapid production of heat is desirable.

The advantages of such a substitute for coal are readily apparent—less storage room, complete combustion, etc. It is surprising that petroleum has not been utilized more generally in this form. The objections are that the briquettes injured the boilers after a short time, by reason of some chemical action produced by combustion; further, the blocks did not keep their form under the action of the heat, but fell through the fire box in a liquid state, and the price is stated to be two-thirds more than that of coal.

A company has recently been formed at St. Etienne for the manufacture of petroleum briquettes which claims to have obviated all the objections except that in regard to price. The advantages of the product are set forth as follows:

The briquette is composed of 97 per cent of petroleum and 3 per cent of hydrocarbon. The volume being equal, it weighs only half as much as coal and gives but from 2 to 3 per cent of residue; it produces no slag; it does not "run" when lighted and keeps its form like coal; it burns without odor and without smoke; it may be wetted with impunity, losing none of its properties; it consumes without explosion or sparks and yet with a bright and long flame; it may be kept indefinitely without deterioration. By this process a degree of saponification is obtained by which the briquettes are rendered unchangeable even to the extent that if a projectile should enter a ship's bunker filled with this fuel, there would be no danger whatever of explosion, the effect being the same as in the case of ordinary coal.

The average heating power is from 12,000 to 14,000 calories, and the briquettes can be employed in any fire box or in any grate for domestic purposes.

The manufacture of these briquettes is very simple and requires but little machinery. If necessary, the petroleum contained therein can be recovered with a loss of only 5 to 7 per cent.

The same company manufactures what are called mixed briquettes—half coal and half petroleum,—but if these are cheaper than the former, they present less advantages, from the fact that the density is greater and the heating power is only 9,000 calories. A steamer carrying 8,000 tons of coal would require 3,500 tons of mixed briquettes and only 2,500 of the pure petroleum briquettes.

The petroleum used by the company comes from the United States, and only the refined quality is employed. When I asked why the managers did not employ the Russian oil, they replied that while the price was the same (12 francs per 100 kilograms, or $2.31 per 220 pounds), the latter was less refined, as it contained more greasy matter.

A short time ago the company submitted the briquettes to the Government and after several experiments a trial order for 150 tons

was given, to be delivered as quickly as possible. This order is now being executed.

A group of capitalists at Marseilles is about to buy the invention of the St. Etienne company and form a company with a capital of 4,000,000 francs ($772,000), to establish manufactures at Marseilles, Suez, Batum, etc. The selling price of the briquettes will be about 8 francs per 100 kilograms ($1.54 per 220 pounds).

As an indication of the interest the French Government is taking in this new fuel product, it has ordered that all the petroleum used in filling its order shall be admitted free of custom duties.

Owing to numerous inquiries received, I think it well to supplement my former report on the subject of petroleum briquettes by some additional information in regard to their manufacture and uses.

The briquettes are mostly composed of petroleum, crude or refined, and possess all the advantages of coal and petroleum without the inconveniences of either. They weigh one-half as much as coal; leave only 2 to 3 per cent of residue; do not form clinkers; do not melt or run; burn without smell or smoke; do not absorb moisture; will float on the water (density, 0.850); do not explode and are not liable to spontaneous combustion under any circumstances; will keep indefinitely, retaining all their qualities of combustion; give off a very white flame 8 to 10 inches high; produce twice as much heat as coal; can be used in any kind of furnace, and are easy and agreeable to handle.

MODE OF MANUFACTURE.

The manufacture of these briquettes is very simple. They are made without heat and no danger attends the operation.

The petroleum is placed in one tank and the chemicals in another, and both are allowed to run into a mixing apparatus, when the chemical combination is formed immediately. The product is then passed to a press, where the desired form is given. The briquette is now ready for use, or it can be stored. The pressure used in molding the forms is about 300 pounds per square inch.

As will be seen, the mode of procedure is very simple and the necessary plant inexpensive, requiring only tanks, mixer, and press, with small motor power for the latter two. Works erected at a cost of, say, $20,000 would turn out several hundred tons a day.

The use of this chemical combination as a binder and enricher solves a difficulty frequently encountered in the making of coal-dust or sawdust briquettes.

USES AND ADVANTAGES.

The petroleum briquette is especially suitable for torpedo boats and as emergency fuel on larger vessels; for its density, as compared with

coal, will allow a steamer to accomplish twice as great a distance as with the same volume of coal. If a boat, for instance, takes 2,000 tons of coal to steam a certain number of miles, it would require only 1,000 tons of petroleum briquettes to cover the same distance; consequently that vessel would be able to carry 1,000 tons more fuel or an equivalent amount of cargo.

A boat using petroleum briquettes could get up steam in one-fourth or one-third of the time required by coal. Further, a boat steaming with petroleum briquettes would show no smoke, which is important to naval vessels under many circumstances.

Petroleum briquettes can be used for any kind of domestic or industrial work without changing the furnaces. For fire engines, where the rapid raising of steam is of great importance, these briquettes would seem to be the ideal fuel.

As to the cost of manufacture, it appears that the oil is the greatest item, that of the other ingredients labor and machinery, being comparatively little.

It is impossible for me to comply with the request for samples received from numerous American correspondents, as the inventors will give none. Neither can the character of the chemicals used nor the exact process of mixing be learned. However, I may aid those interested by giving the address of the recently appointed American agent of the company, viz, Mr. King, 23 boulevard des Italiens, Paris.

After the careful experiments made by French authorities, the fact that these briquettes are likely to be adopted by the Government would indicate that they are considered a success.

As to the price, it is estimated that they could be sold for 8 francs per 100 kilograms ($1.54 for 220 pounds)—in other words, $14 per short ton.

GERMANY.

REPORT FROM CONSULATE-GENERAL AT BERLIN.

Among the several branches of German industry which deserve the attention of Americans by reason of their economy, their recovery or utilization of some raw material which exists unused in our country, or because they involve the most intelligent application of scientific knowledge to technical processes, may be reckoned the manufacture of briquettes from brown coal, peat, and the dust and waste of coal mines. Briquettes form the principal domestic fuel of Berlin and other cities and districts in Germany. They are used for locomotive and other steam firing, and are employed for heating in various processes of manufacture. For all these uses they have three tangible advantages. They are clean and convenient to handle, they light

easily and quickly, and burn with a clear, intense flame. They make practically no smoke and are, withal, the cheapest form of fuel for most purposes.

Like most other important German industries, the briquette manufacture is controlled by a syndicate which includes among its members thirty-one firms and companies, or more than nine-tenths of all the producers in this country, and regulates the output and prices for each year. From the official report of the syndicate for 1901, which has recently appeared, it is learned that the total output during last year was 1,566,385 tons, to which is to be added the product of makers outside the syndicate, consumed at works, small retail sales, etc., making a grand total of 1,643,416 tons.

The average selling price in large quantities was 13.33 marks ($3.16) per ton, against 12.27 marks ($2.92) for the year previous, so that notwithstanding the general relaxation of industrial activity and the diminished pressure upon the coal supply, the ruling price was the highest that had been realized since 1891. Of the 1,566,385 tons sold by the syndicate last year 749,208 tons were taken by the German railways, 124,380 tons were sold to retailers, 497,136 tons were sold to factories and works of various kinds, and 149,089 tons, or 9.8 per cent, were used by German merchant steamers and the navy or exported to the German colonies or neighboring European countries.

The following tabulated statement shows the production, the sales of the syndicate, and the mean price per ton for the past eleven years:

Year.	Production.	Sales of syndicate.	Price per ton.	
	Tons.	*Tons.*	*Marks.*	
1891	482,495	202,780	12.67	$3.02
1892	533,075	516,508	10.47	2.49
1893	694,025	645,144	9.08	2.16
1894	745,414	719,258	8.82	2.10
1895	796,363	780,185	9.07	2.16
1896	830,985	817,300	9.34	2.22
1897	943,732	934,221	9.99	2.38
1898	1,078,113	1,245,269	10.22	2.43
1899	1,530,816	1,485,130	10.66	2.34
1900	1,563,928	1,519,811	12.27	2.92
1901	1,566,385	1,560,230	13.33	3.17

The syndicate produces to a large extent briquettes made from coal screenings, which require a matrix or binder of some plastic, inflammable material, and for this purpose 116,956 tons of mineral pitch were used, which cost on an average about $10.25 per ton delivered.

It need hardly be said that the general use of briquettes for domestic fuel in a large, densely built city, as well as for generating steam in a number of electric generating plants and factories, must have a decided and beneficial influence in reducing the smoke, which in most American cities has become a persistent and oppressive nuisance. Berlin, although a busy manufacturing city, ranks as one of the cleanest and best kept in Europe. One of the first things usually

noticed by American and English travelers visiting the German capital for the first time is the absence of that cloud of dusty smoke that overhangs so many towns and cities in our country. The reason for this lies in three facts: The preponderant use of coke and briquettes, which are practically smokeless; the skillful scientific construction of boiler furnaces and chimneys, and, finally, the high standard of skill that is taught and enforced among firemen who stoke furnaces with coal for steam and manufacturing purposes. It is not every strapping laborer who can shovel coal who is permitted to stoke a boiler furnace in this country. Before he can assume such a charge he must be taught the theory and practice of economical, scientific firing, by which the coal is distributed in such manner and quantity over the grate surface as to secure the most perfect combustion of its volatile elements. The Silesian coal used here in most large steam plants and factories is rich in bitumen and would rank below many of the bituminous coals of the United States, and yet the long, dense, trailing clouds of smoke from mill and factory chimneys which are so familiar a sight in many American cities are rarely seen in this section of Germany, where the indiscriminate shoveling of raw bituminous coal into the steam and other furnaces is considered an ignorant and wasteful proceeding.

Coke making in retort ovens, by which every element is saved and bituminous coal converted into smokeless coke and gas, is another important factor in German fuel economy and abatement of the smoke nuisance. If American municipalities beyond the economic range of anthracite are ever emancipated from their present vassalage to the smoke incubus, it will be through the enforced use of one or more of three forms of prepared fuel, viz, coke and fuel gas made in closed ovens from bituminous coal, and briquettes made from lignite, peat, and other inferior materials by processes which have been invented, tested, and proven to be efficient by the older and more economical countries of Europe.

FRANK H. MASON, *Consul-General.*

BERLIN, *July 25, 1902.*

GERMAN PROCESSES AND MACHINERY FOR BRIQUETTE MANUFACTURE.

In a recent report from this consulate[a] some account was given of the use of briquettes made from brown coal, carbonized peat, coal dust, etc., as domestic and steam fuel in Berlin and other German cities, and the wholesome effect of such fuel, together with coke and fuel gas, in preserving municipalities in this country from the smoke nuisance which has become so serious an inconvenience to many indus-

[a] See ante.

trial towns and cities in the United States. That report, having been published at a time when public attention had been especially drawn to the general subject of fuel by the prolonged miners' strike in Pennsylvania and the consequent scarcity and increased cost of anthracite coal, has caused an unusual number of inquiries for further and more specific information concerning the extent of the briquette manufacture in Germany, the kinds of machinery employed, where and by whom manufactured, the raw materials consumed, cost of plant with a specified daily capacity, and, finally, the names and addresses of briquette manufacturers in this country who would probably answer technical questions on this subject which might be submitted by correspondence. With a view of covering as far as practicable the general range of these inquiries, the present supplemental statement is submitted.

There were in operation in Germany at the close of 1900 89 manufactories of fuel briquettes, some of which—for example, the "Hercules," the "Seven Planets," and the "Tiefbau," at Dalhausen, on the Ruhr—produce each more than 100,000 tons annually. Briquette works are divided, in respect to the material employed, into two general classes, viz, those which make briquettes from brown coal (lignite) or carbonized peat, with or without the addition of a bituminous matrix or binder, and, second, those which use as a basic material coal dust or slack—the waste of soft-coal mines. Of the latter class, Messrs. Franz Haniel & Co., of Ruhrort on the Rhine, who have works at several points along the Rhine, are representatives. The great Gruhl establishment at Brühl, the "Donatus" works at Liblar, near Cologne, and the Thuringian Aktiengesellschaft, at Deuben, near Halle, are typical examples of factories which make briquettes from brown coal, which is abundant and cheap in many sections of Germany. In the last-named establishment no matrix or binder is used. The lignite is crushed, moistened with water to the consistency of mortar, then passed through the machine, which, by compression under heat, develops the bitumen in the material and renders the mass so plastic and adhesive that it molds rapidly into smooth, glistening briquettes of a black or dark-brown color, which are practically smokeless and leave after combustion a reddish-brown ash. All processes of this kind are based upon the fact that lignite is a vegetable coal of more recent formation and, therefore, less perfectly carbonized structure than anthracite or bituminous coals, has lower caloric value, and requires to be compressed and further carbonized by artificial means. Turf or peat is a still more recent formation, and requires proportionately more artificial preparation to produce a high-class fuel; hence the several more or less successful patented processes for carbonizing peat into so-called peat coal, an artificial product which can be either used in irregular lumps or molded into briquettes.

From what has been previously reported on this subject it will be apparent that in all that concerns the manufacture of briquettes from brown coal or from the slack and waste of bituminous coal mines the processes employed in France and Germany have long passed the experimental stage and become a standard commercial industry. If Americans are really interested in the subject, there is no need that they should risk any large sums of money in uncertain experiments. They have only to study the machinery and methods employed in European countries, compare their crude materials with those found and used here, and they can thus start at the point of technical knowledge which Europeans have reached after many years of experience. When, some ten years ago, the attention of American iron makers was called to the German system of making blast-furnace coke in retort ovens, which saves the valuable volatile elements of the coal, it was thought worth while by certain of them to bring over two carloads of Connellsville coal to be coked as a test by the German process. The complete success of that experiment decided the introduction of the standard German type of coking oven into the United States.

Something similar, it would seem, might profitably be done with the materials which Americans have not yet succeeded in converting into satisfactory briquettes. There are experienced engineers and a dozen manufacturers of briquette-making machinery who would gladly cooperate in these tests and would furnish machinery adapted to working the material thus technically defined. Upon a basis of such tests, plans and estimates could be obtained for the erection of plants in the United States with specified daily capacity. Among the builders of briquette-making machinery in Germany, the following may be cited as of standard reputation, the first two named being more specially concerned with apparatus for making briquettes from coal dust and slack, while the latter build machinery for briquette making from brown coal and peat:

The Düsseldorfer Eisenwerke, A. G., No. 55 Bruch Strasse, Düsseldorf.
Schichtemann & Kraemer, Dortmund.
Tigler Maschinenbau Gesellschaft, Meiderich-on-Rhine.
Röhrig & Koenig, Magdeburg-Ludenburg.
Maschinenfabrik Buckau, 82 Schönebecker Strasse, Magdeburg.
Zeitzer Maschinenbau Gesellschaft, Zeitz, Saxony.
E. Fietsch & Co., Thurm Strasse, Halle a. S.

Mr. Robert Grimshaw, an American engineer of large experience on the subject, whose address is at 9 Warmbücher Strasse, Hanover, may be consulted personally or by correspondence by those who may desire technical information as to machinery or methods, the cost of plants, etc.

PATENTED MACHINERY FOR MAKING PEAT BRIQUETTES.

It remains to speak of several recently invented and patented processes by which artificial coal or briquettes have been more or less successfully produced from peat by the application of machinery or methods not yet fully established on an industrial basis. Inevitably, a description of such a process must rest to a greater or less extent on the specifications and claims of its inventor, and it will be understood that in the following brief citations no opinion or estimate is offered of the practical value of the methods described.

The Stauber process for drying moist substances was first brought into prominent notice in connection with peat-coal manufacture in 1901, when the Imperial testing station, at Charlottenburg, announced, as the result of experiments made with peat briquettes made by the Stauber system, that they contained 45.14 per cent of fixed carbon, 4.54 per cent hydrogen, 29.34 per cent oxygen, and 9.09 per cent ash and had a thermal value of 3,806 calories. The Stauber system as thus applied includes a process for rapidly drying the moist peat by means of heated and compressed air within a closed chamber or channel commúnicating with conduit pipes in such manner that heated air can be forced through the drying channel and cold air through the outlet pipe, the effect being that the cold air quickly absorbs the hot, saturated air out of the drying chamber and condenses it in the conduit pipes, thus greatly stimulating the process of evaporation by which the peat is dried. Peat in its raw state contains from 70 to 85 per cent of water, and in the humid climate of northern Europe is usually a very difficult material to dry. It is claimed for the Stauber method that it reduces the moisture to 18 or 20 per cent quickly, effectively, and, what is important, without changing the chemical composition of the peat or in any way adding to it. The drying machine is in the boiler form (cylindrical) and of a size to conveniently produce 5 tons of dried peat per day. In a large plant this unit would be simply repeated, as a number of machines can be worked with air currents generated by the same engine. A large plant for working the process is now in course of erection near Königsberg, on the Baltic Sea, and another is already in operation at Ostrach, in Wurttemberg. A sample briquette from the latter establishment and a sample of coal made from peat prepared by the Stauber process are transmitted as exhibits with this report.[a] The peat coal can be used for locomotive or other fuel raw, or it can be coked, and produces a coke wholly free from sulphur and as valuable as charcoal for certain industrial purposes.

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[a] Filed for reference in the Bureau of Foreign Commerce.

Estimates furnished by the company give the cost of a plant capable of turning out 50 tons of peat briquettes per day as follows:

	German currency.	United States currency.
	Marks.	
Buildings	60,000	$14,280
Machinery	75,000	17,850
Steam engine and fixtures	15,000	3,570
Means of transporting material and product	15,000	3.570
Total	165,000	39,270

A second process is that invented by Mr. F. Schülke, of Bach Strasse, Hamburg, the salient feature of which is that the turf or peat used is cleaned of roots, stones, etc., then liquefied by water and pumped through a pipe line several miles to the works, where, as claimed by the inventor, it is leached and converted by heat and pressure into briquettes at a net cost of $2 per ton, or into artificial coal, having a thermal value of 6,250 calories, at a cost of $2.50 per ton. It is understood that a large plant is in process of erection on the northern coast of Germany for the utilization of this method, but as to the actual condition of the enterprise or the practical value of the process on an industrial scale no exact information is at hand.

The Schoening-Fritz process for making artificial coal and briquettes by carbonizing dried peat is an elaboration by a German engineer of the system invented by Schoening and used with more or less success at Stamsund, in Norway. The German patent is owned by a corporation known as the Deutsche Torfkohlen Gesellschaft, which has its office in Berlin and a small plant at the suburban town of Halensee, where two machines of small capacity—one worked by hand, the other by power—have been set up for experimental purposes. A collection of samples of artificial coal made by this process is transmitted as an exhibit with this report.[a] They are made from ordinary brown peat, of which there are thousands of square miles of deposits in the United States, and will be found coal black in color, firm in structure, glazed on the surface, clean as wood to handle, easily kindled, and practically smokeless when burned in an ordinary grate or stove. Drs. Brockhoff and Ehrecker, of Magdeburg, who as experts analyzed samples of coal made by this process, reported that it contained 68.03 per cent of fixed carbon, 4.98 per cent of hydrogen, 5.34 per cent of moisture, 19.89 per cent of oxygen, and 1.76 per cent of inorganic ash and had a thermal value of 6,205 calories. The process consists in compressing dried peat between hot rollers, by which it is simultaneously carbonized and transformed into coal. According to the statement of the inventor, 1 ton (20 hundredweight) of dried peat, costing in Germany about 1.60 marks (38 cents) will produce from 12 to 15 hundredweight

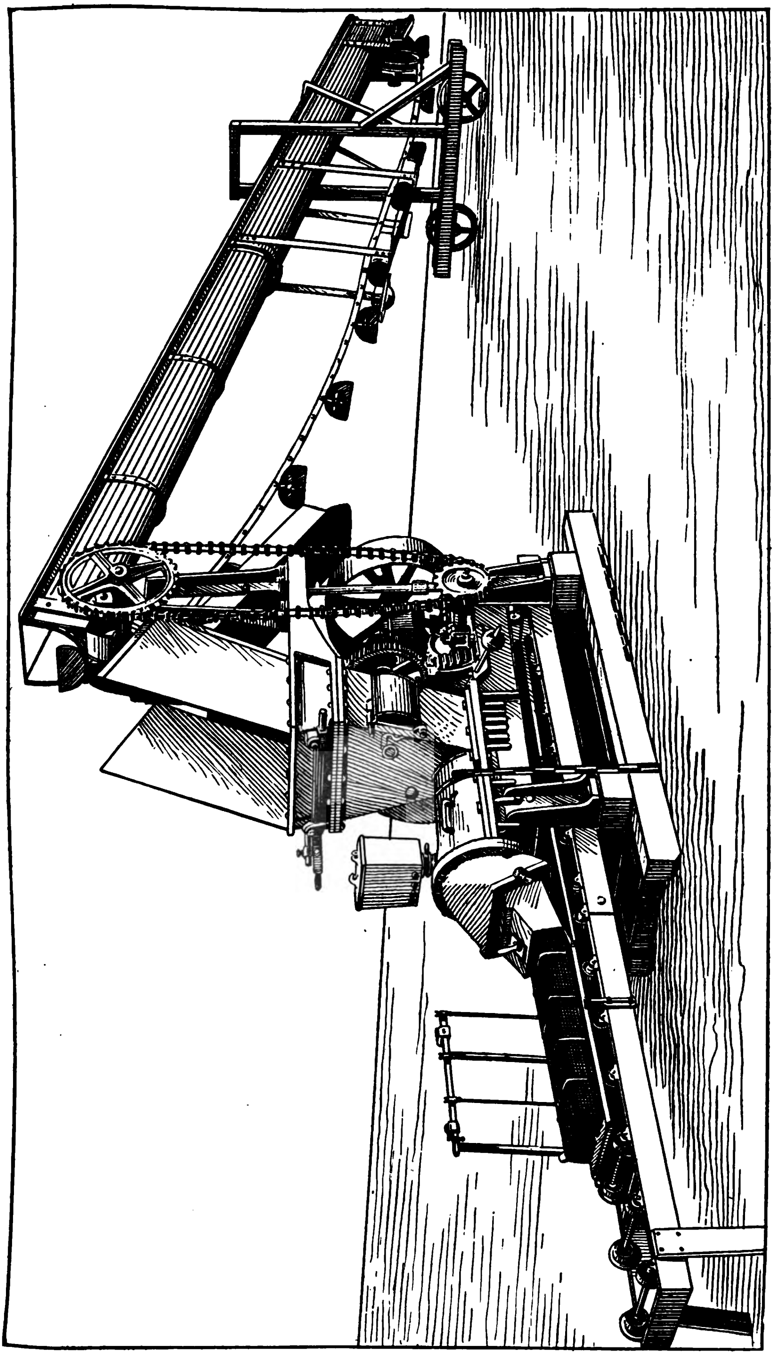
[a] Filed for reference in the Bureau of Foreign Commerce.

of peat coal. To make 1 ton of coal, the cost is 2.67 marks (63 cents) for dry peat; adding 1 mark for labor, the net cost of material and labor for producing a metric ton of peat coal would be 3.67 marks, or 87½ cents. These, be it remembered, are the estimates of the owners of the process, based upon expert tests and laboratory experiments. They are given as notes of progress in the manufacture of artificial fuel in Germany, but they will have a practical interest only when the process has been successfully and continuously worked on a commercial scale.

Of the processes actually employed, the value of which has been fully established by experience, one of the most interesting is that invented by Mr. C. Schlickeysen, of Rixdorf-Berlin, and practically operated there, at Munich, and other places. The peculiar feature of this system is that by it black, dense briquettes of high caloric value are made from peat without the application of heat—simply through the action of kneading and drying.

The following illustration shows a machine of this type in operation, the raw turf coming up by an endless belt or elevator running in the long sloping trough which leads to the peat bed—for these machines are portable and are generally carried on temporary railway tracks, laid so as to enable the machine to follow the point of excavation as the peat bed is gradually exhausted. From the summit of the elevator the raw material drops into the machine, where it is cut, torn, kneaded, and compressed into about two-thirds of its original bulk, and delivered at the end of the machine in cubes of any desired size, which are first dried until they lose about two-thirds of their water, when the drying process is generally completed by artificial means. The principle upon which this machine operates depends upon the fact that peat in its natural condition contains about 80 per cent of water, of which four-fifths is held in mechanical suspension between the hairy vegetable fibers of which the peat is composed, while the remaining one-fifth is contained in the fibers themselves, each of which is a minute hollow tube, in which water is held by capillary attraction. In the ordinary process of drying peat the material is cut into cubes and laid in the air, where most of the water held between the fibers soon leaches out by gravity or evaporates. That which is contained inside the fibers is much more difficult to expel, and for this purpose the fibers must be cut, torn, and compressed until they give up their liquid contents. Nine cubic feet of raw peat is thus condensed by the machine into 6 cubic feet of prepared peat, which still contains about 40 per cent of water, and this is further dried and compressed into 1 cubic foot of black, dry, fossil-vegetable stone of about 1.5 specific gravity, which, like the samples herewith transmitted,[a] can be sawn, planed, and even polished like cannel coal.

[a] Filed for reference in the Bureau of Foreign Commerce.



Machine for making briquettes from peat.

Turf briquettes ordinarily contain about 66 per cent of inflammable elements, the remainder being made up of inorganic ash and water. They are thus inferior as fuel to briquettes made from brown coal, which average 70 per cent or more of inflammable matter. Both represent in their present form the utmost that science has been able to do in utilizing inferior and otherwise almost worthless materials to supplement and eke out the insufficient coal supply of European countries.

FRANK H. MASON, *Consul-General.*

BERLIN, *September 13, 1902.*

GERMAN BRIQUETTE MACHINERY FOR AMERICA.

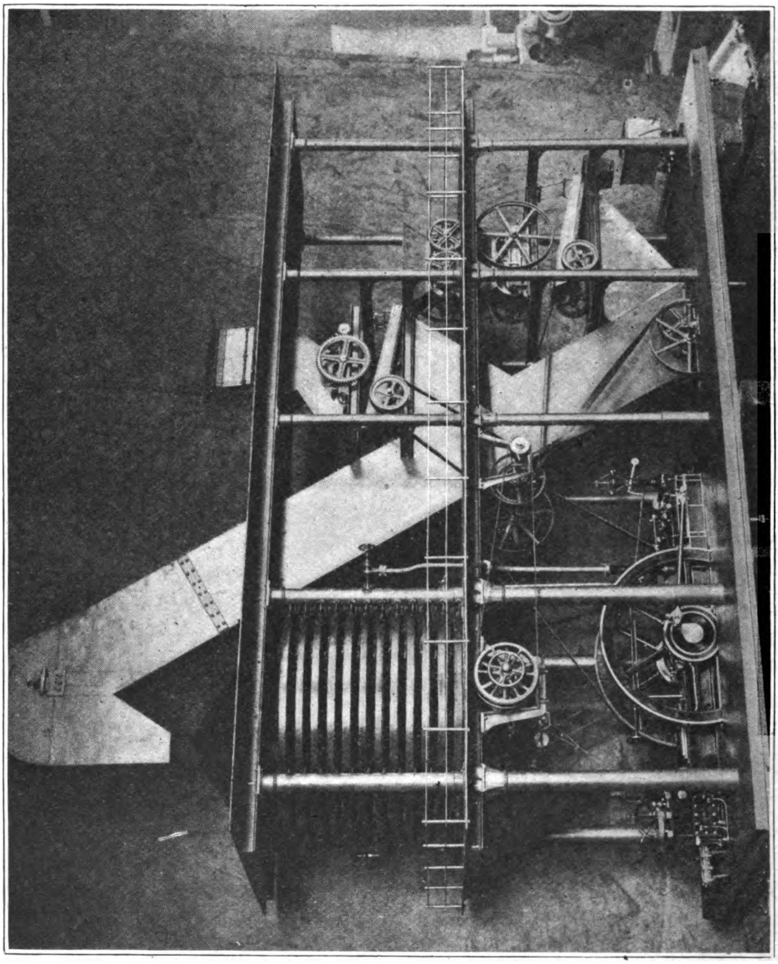
The correspondence received during the past month from nearly every State and Territory of the Union, making further inquiry concerning the machinery and processes employed in Germany for making fuel briquettes from lignite, peat, and coal dust, indicates that public interest in the whole subject of utilizing the hitherto wasted or neglected fuel material, so abundant in America, has been thoroughly aroused. There are in new England, western New York, Michigan, Illinois, Wisconsin, Oregon, and Washington vast beds of peat which have been thus far hardly explored. There are in the Dakotas and the Gulf States large deposits of lignite and material midway in character between lignite and peat, and there are in all the coal-mining States enormous quantities of bituminous dust and anthracite culm, all of which may by the employment of modern machinery and processes be added to the fuel supply of our country.

As has been stated in these reports, this is an industry in which the first tentative efforts made in the United States have generally failed, but which has been developed in Germany, France, and Belgium by long, careful, scientific experience into an important and successful system of production. There is no reason why any American operator or mine owner should risk a dollar in vague or hazardous experiments; he has only to ascertain by expert inquiry what his crude material contains—whether or not it is adapted to profitable conversion into briquettes, and if so, by what processes and machinery it can be most effectively treated. With a view of answering concisely the latest inquiries on this subject and simplifying to some extent the practical proposition, the following résumé of the briquette manufacture, as it exists in Germany is respectfully submitted.

German briquette factories are divided, in respect to the crude material employed, into two general groups—those which make household briquettes from brown coal (lignite) or carbonized peat, and

those which produce the so-called "industrie briquettes," using as basic material coal dust or "slack," the waste of bituminous coal mines.

I. Household briquettes, as made in Germany from brown coal, peat, and to a small extent from anthracite dust, are used for grates, heating stoves, cooking stoves, and ranges, and constitute the principal household fuel of Berlin and other German cities. They are clean to touch, kindle readily, burn with a clear, full flame, and are



Working model of a brown-coal (lignite) briquette factory.

cheaper in Berlin, ton for ton, than anthracite or good bituminous coal. They are made largely from brown coal, in factories located mainly in Silesia, Saxony, and the Rhine provinces, and united in a syndicate which controls the output, regulates the prices, and looks after the general welfare of the industry.

Machinery for the manufacture of briquettes from lignite is made by several large establishment, among which may be cited the Zeitzer

Eisengiesserei, at Zeitz, in Saxony; the Maschinen Fabrik Buckau, at Magdeburg, and the Königin Marienhütte, at Cainsdorf, in Saxony.

The first illustration (see foregoing page) shows a miniature working model of a brown-coal briquette factory which was exhibited by the Zeitz establishment at the recent exposition in Düsseldorf. It exhibits in condensed form the essential elements of such a plant—the machinery for pulverizing, elevating, drying, and finally compressing the material into briquettes.

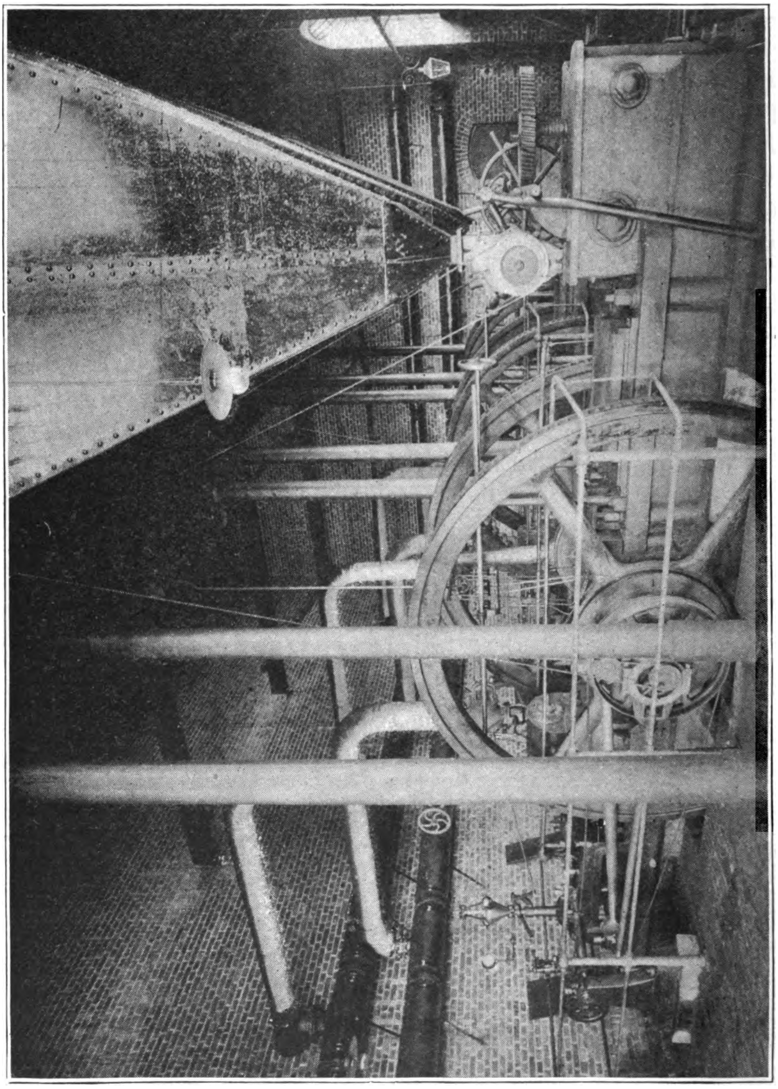
There are in Germany 439 brown-coal mines, which produced last year 44,211,902 tons of lignite, valued at $46,042,500, or a little more than $1 per ton. Of this whole number of mines 181 have each from 1 to 6 briquette factories, in each of which from 1 to 10 presses are employed. The whole brown-coal briquette industry of Germany includes 286 factories, with a total of 691 presses. Statistics of the total yearly product are not accessible, but from the fact that a single press turns out from 50 to 90 tons per day, it will be readily inferred that the annual output is enormous. They are the standard household fuel throughout a large portion of this country, and are besides largely used for firing steam boilers, especially in cities where their cleanliness and freedom from smoke and dust are highly esteemed. The standard household briquette is about 8 inches in length by 4 inches in width and 2 inches thick, and is retailed and delivered in Berlin at prices ranging from $2 per 1,000 in summer to $2.50 in winter.

The second illustration (p. 88) shows a brown-coal briquette factory, with three presses of horizontal type.

II. Industrial briquettes are used in Germany for firing locomotives and other steam boilers, for smelting in reverberatory furnaces, and for many other kinds of industrial heating. They are made of bituminous-coal dust, held together by a matrix of mineral pitch; that is, coal tar derived from retort coke ovens or gas manufacture, and from which the benzole and other valuable elements have been eliminated. Pitch of this quality costs in this country from $10 to $12 per metric ton.[a] The percentage of matrix necessary to be used varies greatly with the "fatness"—i. e., richness in bituminous elements of the coal itself. Slack from very fat coal will work into briquettes with an addition of two or three per cent of pitch, while leaner grades may require 6 to 8 or even 10 per cent, the latter proportion being sufficient, at the present cost of pitch, to render such coal unprofitable for briquette-making purposes. Briquettes made from bituminous slack, although not smokeless, are much more nearly so than ordinary bituminous coal. When burned in locomotives or any well-constructed boiler or other furnace with a good draft, they create only a thin, translucent mist, which contains relatively little soot, and is very different from the inky clouds that roll up from most factory chimneys

[a] 1 metric ton=2,205 pounds.

where soft coal is shoveled indiscriminately into the furnaces. The one notable defect of such briquettes is that the mineral pitch, which is used as a binder, contains more or less creosote; this renders dust and fumes from such fuel acrid and sometimes irritating to the skin



Brown-coal briquette factory, with three presses of horizontal type.

when confined in a close, hot boiler room. Soft-coal briquettes are made from the dust and waste of mines, and, when the composition of the coal is such as to permit a low percentage of binder to be used, they are the cheapest and easiest kind of briquettes to produce. They are made in machine presses more or less similar to the one shown in

the third illustration (p. 90), which is a typical machine of the Zeitz pattern, with a capacity of 90 tons of briquettes per day.

The output of soft-coal briquettes in western Germany is controlled by a syndicate called the Briquette Sale Syndicate of Dortmund, which includes among its members 31 factories, located in Westphalia and the Rhine provinces. These establishments employ, collectively, 112 machine presses of the Couffinhal type, besides 1 French machine of the Bourriez model and 3 so-called "egg rollers," or machines, which produce small, oval briquettes of egg size which are burned in certain kinds of tubular boilers. The syndicate claims a maximum annual capacity of 2,100,000 tons, and, as its official report shows, makes about three-fourths of that amount—whatever the market will take at prices which the syndicate managers consider equitable. Industrial briquettes are usually of a square or oblong form, convenient to be closely packed or built up into a wall, like bricks, whereby they greatly economize space as compared with raw coal. They range in weight from 3 to 10 pounds, and each bears the initials or trade-mark of the company by which it is produced, so that in case of any defect in quality the inferior briquette can be readily traced to its source of production. When burned whole, they are consumed slowly and give out a steady, moderate heat for a long time; when it is desired to quicken or intensify the flame, they are broken up, and in this condition are especially adapted to flue or tubular boilers, sugar evaporating, smelting, and annealing furnaces, in glass manufacture, or in porcelain and cement factories, wherever, in fact, a fuel capable of producing a long, fierce flame is desirable. Their efficiency as locomotive fuel may be inferred from the fact that the State railways of Prussia, which used 130,000 tons of such fuel in 1889, have bought from the syndicate 680,000 tons during the first nine months of 1902.

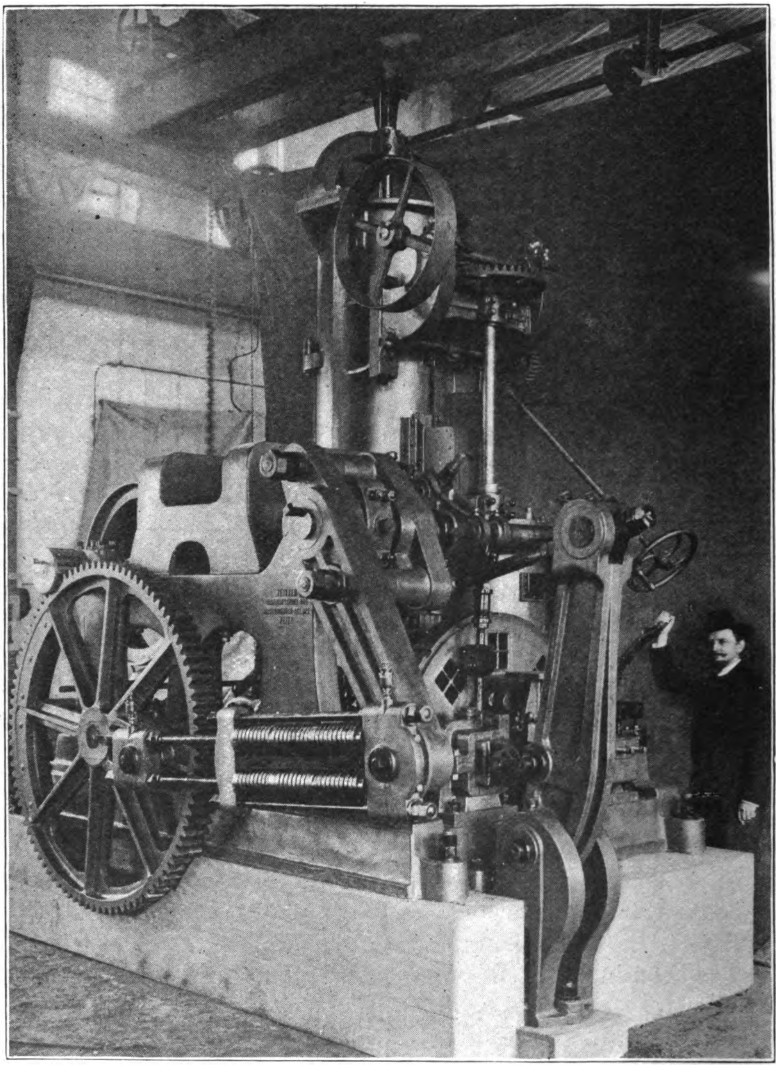
Anthracite coal is so sparingly produced in Germany that the use of hard-coal dust for briquette making is relatively unimportant. Experts, however, agree that with an admixture of from 4 to 8 per cent of matrix, the manufacture of anthracite briquettes, which will bear transportation by sea or land in any climate, presents no technical difficulty.

As has been indicated in previous reports, the manufacture of coke and briquettes from peat or turf is still relatively in the experimental stage, although there are several factories in successful operation and another—the largest of all—is just being put into operation at Königsberg, on the Baltic coast of East Prussia.

The fourth illustration (p. 91) shows the principal peat-briquette factory in this country. It is located near Stettin, has been in operation several years, and is apparently successful.

III. As a result of the present widespread interest in this subject and the many inquiries that have been received from mine owners and

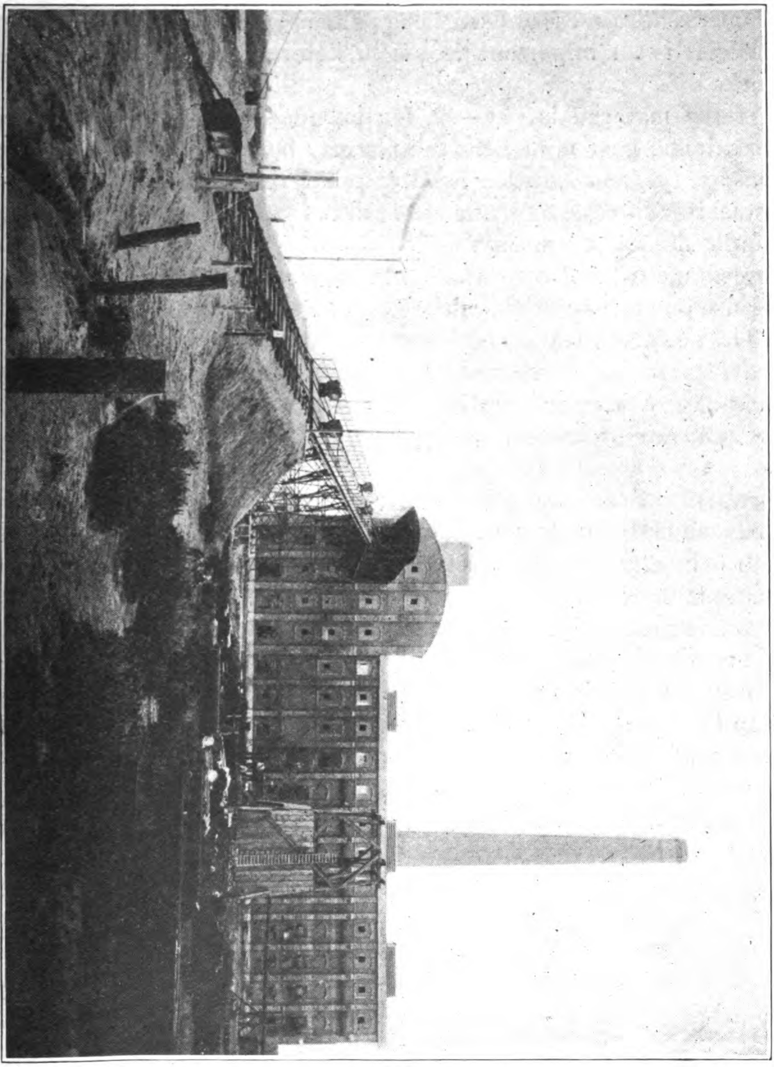
operators for technical information as to processes, cost, and capacity of machinery, etc., a combination has been formed between three of the foremost machine builders in this country, whose products collectively include all the necessary apparatus for making briquettes from coal



Machine press for soft-coal briquettes (90 tons per day).

dust, brown coal, and peat. The purpose of this syndicate is to meet promptly and efficiently the American demand for machinery and working methods, which represent the best results obtained by scientific study and mature experience in Germany. The combination is entitled "The Export Syndicate of Briquette Machinery Manufac-

turers," with central office at No. 59 Friedrich strasse, Berlin, and includes as members the Zeitzer Eisengiesserei at Zeitz, Saxony, the Maschinenfabrik Buckau at Magdeburg, and the Maschinenfabrik (formerly Jaeger) at Ehrenfeld-Cologne. Its plan is to send over, within a few weeks, an experienced engineer, who will establish an



The principal peat-briquette factory in Germany.

office at New York and be prepared to confer with firms and persons who contemplate entering upon the manufacture of briquettes, to examine sites and materials, make plans and estimates for buildings, machinery, etc. An opportunity will be thus offered for American mine owners and operators to ascertain definitely in advance the theo-

retic value of their materials for briquette making and the cost of a plant of a given daily capacity.

Meanwhile the same results can be reached with important saving of time if owners of coal mines or lignite beds will send to the above address, directly or through this consulate, 10-pound samples of their material in the exact condition in which it will be available in large quantities for practical use. The percentage of water in any briquette material is an important factor in determining how it can best be worked.

If the material is dry—as, for instance, slack from a well-drained bituminous coal mine—the sample may be sent in an ordinary box or package. If, on the other hand, the slack or culm is obtained wet from a washing process, or if the material is lignite or peat from a bog, the sample should be sent in a tight tin case, which will preserve the exact percentage of moisture which will be encountered when it is mined for use on an industrial scale.

The postal-package treaty between the United States and Germany provides for the transmission by post, reciprocally, of packages not exceeding 5 kilograms (about 11 pounds avoirdupois) in weight at a uniform rate of 12 cents per pound. Allowing for the weight of the necessary covering, this will enable interested persons in America to forward to Berlin samples of their material sufficient in quantity to be analyzed, submitted to various tests, and even made experimentally into briquettes, so that its adaptability to briquette manufacture, the percentage of binder required, the caloric value of the product, and methods and machinery best adapted to working it can be ascertained and reported on in advance by responsible experts, who are prepared to follow up their estimates by practical operations.

In this way the technical experience and scientific knowledge which have made the briquette industry successful and important in Germany will be made directly available by American operators who desire to begin at the point of economic efficiency that has been attained by the best practice in Europe.

FRANK H. MASON, *Consul-General.*

BERLIN, *November 20, 1902.*

LIGNITE, PEAT, AND COAL-DUST FUEL IN GERMANY.

Since the publication of the last report of this series (see ante[a]) on the methods of manufacturing fuel briquettes from coal dust, lignite, and peat in Germany, two experienced engineers—one from New York the other from Minnesota—have come to this country to make

[a] The reports by Consul-General Mason were published in Advance Sheets of Consular Reports.

careful scientific studies of the subject for the purpose of assisting to transplant the industry, or such of it as may be adaptable to American conditions, to the United States. Both these experts have declared themselves astonished by the proportions of the fuel-briquette manufacture in Germany, the size and number of factories engaged, the amount of capital invested, the technical excellence of machinery employed, the permanent fireproof buildings, and the modernized methods of handling materials and product. One of them said:

> Of all this, we have at home not the faintest conception. We read a consular report that there are in this country 286 brown-coal-briquette factories with 691 presses; that they work up annually 44,211,000 tons of lignite; and that the 21 coal dust-briquette factories of the Dortmund Syndicate alone turn out 2,100,000 tons of "industry briquettes" per annum, but such figures leave no definite impression. We haven't got beyond the stage where a more or less experimental machine press under a wooden shed is considered a briquette factory.

Meanwhile each American mail continues to bring inquiries from owners of lignite, peat, and coal properties in many States and Territories, all asking for further details concerning German processes, the cost, capacity, and productiveness of machinery, thermal values and market price of the various kinds of briquetted fuel, and other information which it is difficult to condense into ordinary correspondence. With a view of answering more fully these inquiries—which at present relate more especially to the utilization of lignite and peat deposits—the present supplementary report is submitted.

I. THE LIGNITE-BRIQUETTE MANUFACTURE.

It has been repeatedly stated that the outward cleanliness of Berlin and other German cities is principally due to the general consumption of brown-coal briquettes for household and steam fuel; further, that they are made from ordinary German lignite without the use of tar or other artificial binder; that they are compact to store, clean to handle, easy to kindle, burn with a clear, strong flame, are cheaper than good bituminous coal, and are made practically smokeless. Lignite varies in its value and adaptability for briquetting purposes according to its geologic age, hardness, and the percentage of water contained. A lignite with less than 30 per cent of water is very difficult to work by the usual processes, and it is for this reason that Austria-Hungary, which has an abundance of very old and hard brown coal that contains from 26 to 28 per cent of moisture, has practically no supply of briquettes from that source. German lignite, on the other hand, is of much more recent formation; it contains from 46 to 52 per cent of water, and is usually so soft that it can be cut with a spade. Many lignite beds in this country are filled with logs and pieces of wood, so well preserved in the matrix of partially carbonized material that they burn readily and form a cheap and abundant fuel for steam and other heating at the

briquette factories. The part played by the water contained in lignite forms the key to the whole economic briquetting process. The crude brown coal is brought from the mine, crushed and pulverized, and then run through a large revolving tubular cylinder, heated by exhaust steam from the driving engine, and hung on an inclined plane so that the powdered material runs downward through the tubes by gravity, and is carried into the machine press that stamps it into briquettes. During this passage through the cylinder, it is dried and heated until there remains the right proportion of moisture, combined with the proper temperature to develop the latent bitumen in the lignite and make the powdered mass plastic and easy to mold under heavy pressure between heated iron jaws into a hard, clean briquette, with a glistening surface and sufficient firmness of structure to stand weather, transportation, and other contingencies. To do this perfectly and economically, the natural lignite should contain, as it comes from the mine, approximately enough water so that heating to the proper temperature for pressing will evaporate out just sufficient water to leave it at the proper degree of moisture. The ideal proportion is about 45 per cent of water, so that German lignite contains rather too much, while Austrian contains much too little, though this latter difficulty has lately been partially overcome by steaming. The important question to be now decided is how American lignite will fulfill these requirements.

During the past six weeks samples of lignite from near Bismarck, N. Dak., and from Troy, Ala., have been received at this consulate, turned over to the syndicate mentioned in the last report, and molded experimentally into briquettes with entire success. The Dakota lignite is old and hard, contains 38 per cent of water, but crushes and pulverizes easily and forms without binder briquettes of firm structure, which burn readily, are practically smokeless, and leave only 4 per cent of ash, while the best German brown-coal briquettes yield from 9 to 12 per cent of inorganic residue. The percentage of water contained is rather low, but by adapting the heating-drying process to that proportion of moisture, this obstacle, such as it is, can be easily met, and the reduced task of evaporation will be an economy in the general process.

The Alabama lignite, on the other hand, is an ideal material, and from the one sample submitted is conceded here to be even superior to the standard brown coals of Germany. It contains the direct percentage of moisture, crushes easily, and molds readily into firm, shining, black briquettes, so clean that, as one of the experts at Magdeburg said, "They might be used for paper weights."

The importance of these simple demonstrations will be inferred from the fact that, according to a recent State geological report, there are 55,000 square miles of lignite beds in the Dakotas and Montana,

all near the surface of the ground, and ranging in thickness from 20 to 80 feet. The extent of the lignite deposits in the Gulf States is perhaps less exactly known, but they certainly cover a large area. There is also lignite in Missouri, Iowa, and several other Western States and Territories, and it is from all those hitherto practically neglected deposits that an inexhaustible future supply of smokeless domestic fuel will be derived. It will therefore be of interest to state concisely what constitutes a first-class, up-to-date lignite-briquette factory in Germany, where the industry has reached, after many years' experience, its highest development. A typical example is the factory at Lauchhammer, about 80 miles south of Berlin, on the direct line to Dresden. This establishment, which is of the latest and most approved construction, has eight presses, with the necessary pulverizing, heating, and drying plant, run by electric motors with current generated by steam evaporated with wood from the mines, the whole under handsome, substantial buildings of brick, stone, and iron, and cost, with tracks, switches, and full equipment for handling raw material and loading the briquettes into cars, $371,000, of which $178,500 was paid for machinery. Each press weighs 32 metric tons and stamps out 100 to 120 briquettes per minute, or 70 tons in a double-turn day's work of twenty hours. The heating and drying apparatus for each press weighs 18 tons. The power required for each press and dryer is 125 horsepower, and both the dryer and jaws of the press between which the briquettes are squeezed at enormous pressure are heated by exhaust steam from the Corliss engine in the power house, the whole supply for the eight machines being equivalent to about 150 horsepower.

Thus equipped, the plant at Lauchhammer turns out from 500 to 600 tons of briquettes per day, which sell on cars at the factory for from 7 to 9 marks ($1.66 to $2.14), according to season and market, with an average of 8 marks ($1.90) per 1,000 kilograms, or metric ton of 2,204 pounds. Profits depend on the usual varying conditions, location, management, demands, etc., but it is common to read in the Berlin papers official notices announcing dividends of brown-coal briquette companies ranging from 15 to 20 per cent of their capital. So enormously has the industry been developed in recent years that there is now an overproduction, and it is said that 100,000 carloads (1,000,000 tons) of briquettes will be carried over to the fuel supply of next summer and autumn.

II.—THE UTILIZATION OF PEAT.

Peat as a material for fuel ranks next in natural order below lignite, in that it is of similar but much more recent geologic origin, contains more water, is but slightly carbonized, and has a correspondingly lower thermal value than brown coal. The task of converting peat into serviceable fuel consists in cleaning the material of roots and rub-

bish, reducing the water to a small percentage, and so condensing the peat in volume that its thermal value shall be raised to practical efficiency. This is done by various methods, some of which are in this country as yet partially covered by patents, but they may all be grouped under three heads, according to the form which the ultimate product is to assume, viz: (1) Compressed peat, with or without admixture of coal dust or other inflammable matter; (2) peat coke; and (3) briquettes made by compression, with or without heat, of the material prepared by the first of these processes.

COMPRESSED PEAT.

A pioneer in the invention of machinery and processes for making compressed peat in northern Europe appears to have been Mr. C. Schlickeysen, of Rixdorf, near Berlin, whose installation and present methods have been mentioned in a previous report of this series. His first two machines were of vertical construction, and were built in 1859 for a steam peat-compressing plant at Zintenhof, near Riga, in Russia, where they worked successfully for many years, turning out daily about 80,000 pieces of wet compressed peat, which, after drying, were used as smokeless fuel in a large cloth factory at that place. During the ensuing forty years he has built peat-compressing plants in Holland, Hungary, Switzerland, and at various places in Germany, constantly improving his equipment and processes with a view of perfecting the product, cheapening its cost, and substituting more and more automatic machinery for manual labor, until the system so evolved may be accepted as standard in this country.

Raw peat, as it comes from the bog, contains about 85 per cent water, 13 per cent combustible material, and 2 per cent inorganic matter. To obtain the 13 per cent of combustible elements in the cheapest, most direct manner, the peat is cut with spades and shoveled into the trough of a long, sloping belt-and-bucket elevator, which carries it up and drops it into a machine which cuts, tears, kneads, and mixes it to uniform consistency, in which state it passes downward and is forced out by a horizontal screw into long, plastic skeins about 3 by 4 inches in transverse section. These are delivered at the tail of the machine on boards 3 feet long, which are lifted off by hand when filled, laid on tram cars, and run out to a cleared space, where they are laid in rows on the ground and the skeins cut with a knife into bricks or sections 10 inches long, which, being left to dry, lose by exposure in ordinary weather one-half their water contents in a period of two weeks. The peat loses by this machine process one-third its bulk, so that a machine which works 21 cubic meters[a] of raw turf per hour delivers 14 cubic meters of clean peat or 7,000 wet bricks of the size indicated, which contain from 3 to 4 tons of dry compressed

[a] 1 cubic meter = 35.316 cubic feet.

peat in a condition to be used as fuel. A plant of this kind includes, besides the elevator and grinding press, a 10-horsepower portable engine, which is fired with peat refuse, and cars and tracks for handling the material. The whole plant is movable, is taken bodily to the bog, set up at the farther edge of the moor to be worked, and moved backward as the peat bed is excavated and exhausted. An important recent improvement by Mr. Schlickeysen is an excavating machine, which in moors reasonably free from logs and stones digs and elevates peat with great rapidity, thus saving the hard, wet, unhealthy work of several men. The cost of such a plant, complete, with engine, tracks, cars, etc., ready to operate, is 18,620 marks ($4,431), and its operation, when used without machine digger, employs 17 men besides engineer and fireman, a total cost for labor in north Germany of 120 marks ($28.56) per day. After air-drying on the ground until their water contents are reduced to 38 or 40 per cent, the peat blocks are built up in open formation, like bricks in a kiln, to dry until the water is reduced to 15 to 18 per cent, when they become a fuel with a thermal value of 3,000 to 4,000 calories. This value may be increased by converting the air-dried peat into briquettes, which is done by heavy pressure with heat in a machine press specially constructed for the purpose.

One of the important improvements of recent years has been attained by mixing the peat pulp, as it passes through the grinding machine, with other inflammable materials, viz, bituminous-coal dust or slack up to 30 per cent, anthracite culm to 40 per cent, or dry sawdust to 15 per cent. These dry, pulverized materials, when mingled with the wet peat, not only greatly enhance its subsequent value as fuel, but facilitate the drying process and render it tough, dense, elastic, and capable of being pressed cold into salon briquettes of high quality.

There are in the State of New Jersey, within easy distance of the coast, extensive peat beds which have not hitherto been utilized. There are at the terminal coal yards in Jersey City and Hoboken large quantities of coal dust, both anthracite and bituminous, that are treated as waste. May not the neglected peat and the worthless dust of the coal yards be combined by processes already perfected and successful here into a clean, cheap, and effective fuel for household purposes?

PEAT COKE AND SECONDARY PRODUCTS.

But by far the most modern, scientific, and rational method of utilizing peat appears to be that of converting it into coke, by carbonization in retort ovens with recovery of the gas, tar, and other by-products of distillation. This has been the subject of many years' study and experiment in Germany, the best results of which have been embodied in the system perfected and patented by Martin Ziegler, a chemical engineer of high reputation, which gives to the manufacture of peat

coke the dignity of a perfected industrial process. Concisely stated, the Ziegler method consists in carbonizing peat in closed ovens, heated by burning under them the gases generated by the coking process itself. Such a plant is therefore self-sustaining, the only fuel required being coal or wood sufficient to heat the oven for the first charge, when the gases generated by the coking process become available and enable the operation to be repeated and continued indefinitely. Not only this, but the offheat from the retort furnaces passes on and heats the drying chambers in which the raw, wet peat is prepared for the ovens by drying to the point of economical carbonization. There is transmitted to the Department as an exhibit with this report a sample[a] of 1 kilogram (1,000 grams, or 2.2 pounds) of raw peat and the several products derived therefrom by the Ziegler process, each in its due proportion, as follows: Three hundred and fifty grams of coke, 40 grams of tar, and 400 grams of gas liquor, from which last is derived 6 grams of methyl alcohol, 6 grams of acetate of lime, and 4 grams of sulphate of ammonia. If this sample be multiplied a thousandfold to a metric ton, and the value of each product given at its present market price in Germany, the demonstration would be as follows:

Description.	Value.	
1 ton (1,000 kilograms) of peat, costing, dried, 5 marks ($1.19), produces—	*Marks.*	
350 kilograms (771.6 pounds) of peat coke	15.75	$3.75
40 kilograms (88.2 pounds) of tar	2.20	.52
6 kilograms (13.2 pounds) of methyl alcohol	4.20	1.00
6 kilograms (13.2 pounds) of acetate of lime	.72	.17
4 kilograms (8.8 pounds) of sulphate of ammonia	.88	.21
Total	23.75	5.65

The peat coke produced as the primary product of this process is jet black, resonant, firm, and columnal in structure, pure as charcoal from phosphorus or sulphur, and, having a thermal value of from 6,776 to 7,042 calories, it is so highly prized as a fuel for smelting foundry iron, copper refining, and other metallurgical purposes that it readily commands from 40 to 50 marks ($9.52 to $11.90) per ton. It is also a high-class fuel for smelting iron-ores, but as the process is comparatively new and the output limited, it is yet too scarce and expensive for blast-furnace purposes. Crushed and graded to chestnut size, it forms an excellent substitute for anthracite in base-burning stoves. In larger lumps, as it comes from the oven, it fulfills substantially all the various uses of wood charcoal as a clean, smokeless fuel. The cost of a 4-oven plant, with all apparatus for cutting and drying the peat, distilling the gas liquor, and extracting paraffin from the tar, is given at $95,200. Such a plant is reckoned capable

[a] Filed in the Bureau of Foreign Commerce, where it may be examined by parties interested.

of working up annually 15,000 tons of peat, the various products of which would sell, at present wholesale market prices, for 494,100 marks ($117,596). A plant of 12 ovens, with all appurtenances complete, would cost $261,800 in Germany, and should produce annually products worth $350,000, from which, deducting the carefully estimated cost of peat, labor, depreciation of property, and other expenses—$179,200—there would remain a profit on the year's operation of $170,800. This process is in successful operation at Redkino, in Russia, and the German Government has evinced its practical interest in the subject by placing at the disposal of the company a large tract of peat-moor lands, the property of the State, on which extensive works will be erected during the coming year.

III.—COAL-DUST BRIQUETTES.

While Germany is preeminent in the scientific utilization of lignite and peat as materials for prepared fuel, it is not apparent that this technical superiority is so absolute in the treatment of coal dust. It is true that the coal-briquette manufacture is fully organized and developed in this country, that there are several German builders of coal-briquetting machinery who are masters of that branch of construction; but the same is true of France, Belgium, and England, where the conversion of coal waste into briquettes for locomotive and other steam fuel, as well as for grates and heating stoves, has long been a standard and established industry. It is not known that it has anywhere been found possible to make a marketable briquette of bituminous or anthracite coal dust without the use of a matrix or binder to hold the pulverized material together. The percentage of binder required varies with the composition of the coal, from 2 to 10 per cent, and, as has been previously explained, the pitch of coal tar, which is the binder ordinarily used, costs in Germany from $10 to $12 per ton, and at that price its use for briquetting purposes in a higher proportion than 6 to 7 per cent is commercially unprofitable.

The ingenuity of inventors in European countries has of late years been directed especially toward improvements in binders and the discovery of materials other than coal tar which would answer the same purpose. One hears and reads from time to time of a new matrix which will cheapen the cost of coal briquettes, facilitate their manufacture, or improve their quality; but these accounts are founded rather on the claims of inventors and promoters than on demonstrated industrial results. One of the latest and most interesting of these discoveries is reported from England, where it is stated that Messrs. William Johnson & Sons, makers of briquette machinery at Leeds, have in use a binder produced by an inventor named Cory, which, when used with Cardiff coal, produces industrial briquettes which are practically smokeless. This fuel is under trial by the British Admiralty,

and a photograph has been published showing two war vessels steaming side by side—one burning raw Cardiff coal, with volumes of dense smoke trailing from its chimneys, the other using Cardiff briquettes made by the Cory process, leaving an aerial wake as clear as though the furnaces were stoked with charcoal or anthracite. So far as appears, this process does not claim to use the inferior waste of mines or coal yards, but takes good coal, condenses and renders it compact to transport and, to all practical purposes, smokeless. It is further stated that a machine costing $4,500 will produce 50 tons of briquettes per day, and plans are matured by which one or more of them will be exhibited in operation during the coming exposition at St. Louis.

FRANK H. MASON,
Consul-General.

BERLIN, *March 19, 1903.*

AIX LA CHAPELLE.

There are a number of small briquette factories in the vicinity of Aix la Chapelle, but no pertinent statistics are available. The majority of them are situated at or near the mines, the surplus and waste coal and coal dust from which are utilized. As nearly as I can ascertain, the briquettes are composed, in weight, of 6 parts coal waste or fine coal of a bituminous character, 1 part of good gas or cannel coal, and 1 part of a mixture known as asphalt earth, brai, or tar pitch.

I am unable to ascertain reliably the cost of manufacture, but fine or waste coal costs approximately $1.25 a ton; gas or cannel coal, $2.50, and the asphalt earth, brai, or tar pitch, $10.

The wholesale price for briquettes runs from $4 to $6 a ton.

The Humboldt Actien Gesellschaft, near Cologne; the Couffinhal (an English system), Schüchtermann & Kremer, of Dortmund, and the Zeiter Machinen Fabrik, Germany, all have patented systems and manufacture and erect plants for making briquettes.

The usual method of production is as follows: Three thousand eight hundred pounds of coal waste, 600 pounds of gas coal, and 400 pounds of asphalt earth, brai, or tar pitch are dumped into a cemented vat, whence, after having been partly mixed, they are transferred by means of a chain bucket carrier to a crushing or mixing mill. From this mill the mass is again moved to another vat, where by means of a wheel with perforated paddles it is thoroughly mixed with superheated steam. From the second vat it goes to the molding machine.

The briquettes are made in various weights, from 2 to 10 pounds, and are subjected to heavy pressure. About 15 men and boys are employed at the plant visited by me, the daily output of which, I am informed, is 90 tons.

Briquettes made of good raw material develop about the same heat as does coal. Many thousands of tons of these briquettes may be seen piled in railway yards, for utilization in case of shortage in the coal supply. They are especially desirable in instances where a quick, clean fire is essential. The cost of briquettes to the consumer exceeds that of coal. Of the total German production of this fuel, the railroads utilize about 50 per cent, private houses 8 per cent, factories 32 per cent, and steamships the remainder. The number of tons of briquettes made in Germany in 1901 was 1,566,385.

There are some lignite deposits in the neighborhood of Aix la Chaelle, but in every instance attempts to develop them have failed. There is also considerable peat or turf on the Eifel Mountains, quantities of which are used locally. A large brick plant made an attempt about a year ago to utilize this fuel, but not meeting with success abandoned the venture.

Persons that contemplate engaging in the manufacture of briquettes would do well to apply to Ferdinand Schmetz, Herzogenrath, Germany, a chemist who has given considerable attention to the matter of reducing tar and pitch without damaging their heating, burning, and keeping qualities, and to the exact percentage of mixtures to use in the manufacture of both anthracite and bituminous briquettes.

So far as I can ascertain the briquettes to be successful must be able to withstand the extremes of both heat and cold without deteriorating, and during combustion will neither melt into a mass nor leave a residue.

FRANK M. BRUNDAGE, *Consul.*

AIX LA CHAPELLE, *December 8, 1902.*

BARMEN.

Briquettes are made of different kinds of coal, crushed, sifted, ground to powder, and mixed with coal pitch to facilitate combustion. The following are the three sizes in which the briquettes are manufactured: 220 by 110 by 105 millimeters (8.6 by 4.3 by 4.1 inches), weighing about 3 kilograms (6.6 pounds); 280 by 150 by 110 millimeters (11 by 5.9 by 4.3 inches), weighing about 5 kilograms (11 pounds); 160 by 160 by 105 millimeters (6.3 by 6.3 by 4.1 inches), weighing about 3 kilograms (6.6 pounds). Egg-shaped briquettes of from 35 to 125 grams (1.2 to 4.4 ounces) in weight are also produced.

Compared with the cost of coal, it is said that briquetted fuel represents an economy of from 10 to 15 per cent, and that its residuum amounts to only 6 to 8 per cent.

In the introduction of briquettes for railroad uses, many difficulties

had first to be overcome. For instance, engineers objected strongly to the dust caused by the breaking of the new fuel. In the course of time, however, they learned how to handle the briquettes properly, and now the railroad companies are making use of the latter in large quantities.

The following firms are manufacturers of briquetting machinery, and are ready to furnish on application illustrated catalogues and price lists:

Schüchtermann & Bremer, Dortmund, i. W.
W. Dunkelberg, Bommern, o. Ruhr.
Maschinenbau Actien-Gesellschaft Tigler, Meiderich, n. Ruhsort.
Maschinenfabrik Baum, Herne, i. W.
Petry & Hecking, Dortmund, i. W.
Zeitzer Eisengiesserei und Maschinenfabrik, Actien-Gesellschaft Filiale, Cologne-Ehrenfeld.
Maschinenfabrik Buckan Actien-Gesellschaft, Magdeburg.

Briquettes may be exposed to the open air for several years without loss of quality or weight, the pitch used in their manufacture effectively protecting them from dampness.

It takes 20 per cent less room to store briquettes than coal. Spontaneous combustion of briquettes is impossible, and they will not lose their original shape even though subjected to the extreme heat of the Tropics.

They are especially suited for the use of railroads, steamers, iron works, furnaces, sugar refineries, glass works, porcelain and cement works, dredging machines, and for the household.

The possible output of braunkohlen (soft coal) briquettes (both lignite and peat) in Germany is 10,000,000 tons. The actual production during the present year, however, is estimated to be from 8,500,000 to 9.000,000 tons, of which about 2,500,000 tons are made in the provinces of Rhenish Prussia and Westphalia.

The maximum capacity of the works engaged in the manufacture of Steinkohlen (hard coal) briquettes is said to be about 2,000,000 tons.

The quoted prices per 10,000 kilos (22,046 pounds) are: For soft-coal briquettes, 92 to 100 marks ($21.89 to $23.80); for hard-coal briquettes, 150 marks ($35.70); for egg-shape, hard-coal briquettes, 170 marks ($4.04).

MAX BOUCHSEIN, *Consul.*

BARMEN, *December 4, 1902.*

BREMEN.

There is but little demand for briquetted fuel here, Bremen not only being near the Rhenisch-Westphalian coal fields, but also offering easy access to English coal.

There is no briquette factory in this consular district. I am

informed, however, that the briquette trust, which has its headquarters at Dortmund, controls 31 plants, all situated in the province of Westphalia. In these factories, are in use 122 presses of the system Conffinhal, 1 press of the system Bourriez, and 3 egg-briquette presses, the total annual capacity of which is 2,100,000 tons.

Anthracite siftings under six-tenths of an inch in diameter and all kinds of bituminous coal are utilized as raw material; but as the crushed coal has no cohesive qualities a binding material is required, and for this purpose coal pitch thoroughly comminuted is employed.

As a rule, the briquettes are manufactured in two forms, viz:

(1*a*) Long form, weighing 6.6 pounds, measuring 8.6 by 4.3 by 4.1 inches; (1*b*) long form, weighing 11 pounds, measuring 11 by 9.9 by 4.3 inches; (2) square form, weighing 6.6 pounds, measuring 6.3 by 6.3 by 4.1 inches.

Egg-shaped briquettes are also manufactured. They vary in weight from 1¼ to 4½ ounces. These, however, are not sorted into different grades.

The coal pitch contained in the briquettes ignites quicker than coal and throws off heat more readily; hence it is claimed that steam is produced more rapidly by their use. It is also claimed that they give less smoke.

The experiments made at the imperial navy-yard at Wilhelmshaven show that 1 pound of the best quality of briquettes will vaporize more than 9 pounds of water at 0° C.

It requires a pressure of about 200 atmospheres to form briquettes. Consequently they are very compact and are therefore not easily chipped off or broken. In burning, they leave only 6 to 8 per cent ashes.

Although coal briquettes are not at all popular in Bremen, a great deal of peat is used for fuel. This peat is found in abundance in the numerous bogs on this northern coast of Germany, and I am told by people who use it that it is not only a good substitute for coal, but in some respects is better; it keeps fire longer and costs less.

At Varel, near Bremen, there is a flourishing plant manufacturing peat briquettes, or "Maschinentorf," as they are called, that are spoken of very favorably. This enterprise is operated as follows:

Where the peat strata are thin, the peat is dug with shovels, but where they extend to some depth and there are no obstructions, it is removed by machinery.

The raw peat is comminuted and then put through a shaking and sifting process until all the loose fiber and roots are eliminated and the peat is reduced to a pulp. It is claimed that after the extraction of all the fibrous substances, the peat dries more rapidly, and that a greater compactness or density is attained in the final product.

This pulpy or pappy mass, after being dried, is cut into pieces about 5.5 by 12 by 4 inches, which are again put out to dry, their position being changed frequently, a process which in good weather takes some fourteen days. When these pieces become thoroughly dry, their dimensions have generally shrunk to about 2.7 by 8 by 2.7 inches.

The cost of production, allowing nothing for the fuel used, is about $1 per metric ton, whereas the selling price ranges from $1.55 to $1.65 per ton f. o. b.

The capacity of the plant at Varel, which has six machines and employs a force of 130 hands, is from 200,000 to 250,000 peat briquettes per day, with an approximate weight of 250 tons.

HENRY W. DIEDERICH, *Consul.*

BREMEN, *January 31, 1903.*

BRESLAU.

The amount of briquetted fuel manufactured yearly naturally varies considerably, according to the demand, but a daily production of about 3,500 carloads of about 10 metric tons (22,046 pounds) each and an annual production of some 1,050,000 carloads, or 10,500,000 metric tons, may be taken as approximate amounts.

Briquettes are manufactured from soft bituminous coal and lignite, as well as from a heavy, black "fat peat," without any binding material, and also from a hard bituminous coal, to which pitch is added as a binding medium.

The cost of production is said to be from 35 to 45 marks ($8.33 to $10.71) per 10 metric tons, exclusive of the wear and tear on the plant.

They are sold at 70 to 75 pfennigs ($0.1666 to $0.1785) per centner (110.23 pounds) by the wagonload delivered at the railway, or 90 to 100 pfennigs ($0.2142 to $0.238) per centner (110.23 pounds) at retail delivered at the house.

Briquettes are made from lignite by a process of sifting, grinding, and mixing with water and of drying to a certain consistency, when the mass is again ground and finally pressed, without the addition of any binding material. Turf briquettes are also manufactured in the same way.

The daily production of a briquette plant depends, of course, upon the material to be pressed and the number of presses contained in the plant, which may be from one to twelve. The average in Silesia is about three presses to the plant. Five to six carloads of briquettes may be taken as the average daily production of one press worked day and night.

The plants in this section are located as follows:

Dr. Casimir Dziegiecki, 71 Siebenufenerstrasse, Breslau; Erhardt und Hueppe, 11 Bahnhofstrasse, Breslau.

Gewerkschaft "Cons. Moltke," Crone a Brahe (Posen).
Gewerkschaft "Concordia," Görlitz (2 presses).
"Glueckauf" Actien-Gesellschaft für Braunkohlenverwertung, Lichtenau o.L. (3 presses).
"Saxonia" Braunkohlenwerk und Briquettefabrik Actien-Gesellschaft, Zeisholz bei Bernsdorf (3 presses).
Gewerschaft konsol. Gruenberger Gruben, Gruenberg, Silesia.

The following firms manufacture briquette machinery:

Maschinenfabrik Buckau, Actien-Gesellschaft, Buckau-Magdeburg.
Schuechtermann & Kraemer, Dortmund.
Rudolf Leder, Quedlinburg.
Zeitzer Eisengiesserei, Zeitz, Saxony.

ERNEST A. MAN, *Consul.*

BRESLAU, *February 14, 1903.*

DRESDEN.

In the month of September, 1902, the total output of briquetted fuel in the Kingdom of Saxony amounted to 23,651 tons.

The latest official statistical report on the subject is for 1895. It states that the number of briquettes turned out during that year was 165,000,000; but since that time the industry has made rapid strides.

The materials used in the manufacture of briquettes are washed hard coal (Steinkohle), yielding 5,000 to 6,500 calories of heat; anthracite dust, 6,500 to 8,000 calories; sieved and dried brown coal, 2,000 to 3,250 calories. Small amounts of peat are also utilized.

The selling prices of briquettes at the place of manufacture are:

Hard-coal briquettes	per 10 tons (22,000 pounds)	$30 to $40
Anthracite-dust briquettes	do	50 to 75
Soft-coal briquettes	do	15 to 25

The cost of production naturally varies according to conditions, such as wages, cost of raw materials, degree of humidity of the product, and accessibility to railroads and consuming centers.

The above-stated selling prices net an interest of from 8 to 40 per cent on money invested.

The principal manufacturers of briquette machinery are:

Zeitzer Maschinenfabrik, Zeitz.
Koenigin Marienhuette, Cainsdorf, near Zwickau, Saxony.
Bernburger Maschinen Fabrik, Bernburg.
Hallesche Maschinen Fabrik, Halle a. S.

The peat and lignite is dried by the hot-air process, and as a binding material, pitch (American and Russian), asphaltum, and colophony are used.

The cost of erecting a small plant runs from $10,000 to $25,000. One press produces from 40 to 120 tons per day. Riebecksche

Montanwerke, at Halle a. S., has from 38 to 40 presses steadily at work.

The heating value of hard-coal briquettes is 6,000 to 8,000 calories, and of soft-coal briquettes, 4,500 to 5,500.

ALFRED C. JOHNSON,
Vice and Acting Consul-General.

DRESDEN, *December 20, 1902.*

FRANKFORT.

Fuel briquettes are not produced in this consular district, but I have ascertained the following facts on the subject:

The Prussian Government annually purchases for its railroads more than 500,000 tons of fuel briquettes.

German briquettes vary in weight and shape; for steam boilers they are 8 by 4 by 3½ inches and weigh 6⅝ pounds. A larger size—11 by 6 by 4 inches and weighing 11 pounds—is also used.

The "Egg" briquettes weigh from 1¼ to 4½ ounces.

The binding material consists almost exclusively of hard pitch—a product of coal tar. Oxygenous material, such as manganese, is added in order to obtain smokeless combustion.

The briquette presses work with a pressure of 200 atmospheres.

According to tests made at the imperial navy-yard at Kiel, 1 kilogram of best briquettes, at a heat of 0° C., converted over 9 kilograms, of water into steam.

RICHARD GUENTHER,
Consul-General.

FRANKFORT, *November 21, 1902.*

MAGDEBURG.

In the consular district of Magdeburg, there are at present 10 briquette factories, 7 in the neighborhood of Magdeburg and 3 in the Halberstadt region. These factories have altogether 39 presses, each press producing daily about 50,000 kilos (110,230 pounds).

It is impossible to ascertain the exact amount of briquettes used in this district, but it can be stated that in the Altmark, the northern part of the district, 50 per cent of briquettes is used to 50 per cent of "brown coal" or lignite. In the settlements on the Elbe, however, owing to the cheapness of transportation, 90 per cent of Bohemian lignite is used to 10 per cent of briquettes, while in the region of the Harz Mountains 80 per cent of briquettes is used to 20 per cent of lignite.

In addition, there is an insignificant amount of briquettes of common coal used in iron foundries and sugar refineries.

The cost of manufacture per ton, depending upon the material and the percentage of water it contains, is approximately as follows:

Description.	German currency.	United States currency.
From lignite taken from the open working under good conditions, with water contents of about 46 per cent:	*Marks.*	
In large briquette factories	4.8– 5.4	$1.14–$1.29
In small briquette factories	5.0– 5.8	1.19– 1.38
From lignite taken from the open working, with water contents of more than 46 per cent, in large briquette factories	5.8– 6.8	1.38– 1.62
From lignite taken from the deep working, with water contents up to 46 per cent:		
In large briquette factories	5.5– 6.8	1.31– 1.62
In small briquette factories	6.8– 7.3	1.62– 1.74
From lignite taken from the deep working, with water contents of more than 46 per cent, in large briquette factories	7.0– 7.8	1.66– 1.86
From heavy air-dried peat, with 30 to 40 per cent water, reckoning the peat at 2.8 to 3 marks (66 to 71 cents) a ton:		
In briquette factories with 1 press	7.8– 8.2	1.66– 1.95
In briquette factories with 2 presses	7.0– 7.8	1.66– 1.86
From a lighter air-dried peat, with 30 to 40 per cent water, reckoning the peat at 3 marks (71 cents) a ton	9.0–10.0	2.14– 2.38
From sawdust of soft wood, with 30 to 35 per cent water, reckoning 1 ton of this material at 2 marks (47 cents) in briquette factories with 1 press	6.8– 7.2	1.62– 1.71
From sawdust of hard wood, with 30 to 35 per cent water, reckoning 1 ton of this material at 2 marks (47 cents) in briquette factories with 1 press	6.2– 6.8	1.48– 1.62

In the case of materials containing from 15 to 18 per cent water, for which a drying process is not necessary, the cost of manufacture is naturally considerably lower.

In the factories in this district, however, lignite alone is used in the manufacture of briquettes.

The selling price, depending upon the quality of the briquettes, upon the region where the sale takes place, and upon the season of the year, is between 8.5 and 24 marks ($2.02 and $5.71) a ton. The price of lignite briquettes in this district is usually 7.5 to 11 marks ($1.79 to $2.62) a ton for parlor briquettes and 7 to 9 marks ($1.66 to $2.14) for industrial briquettes.

Complete outfits of machinery for briquette factories are supplied by—

The Fuerstlich Stalberg'sche Maschinenfabrik, Magdeburg.
The Bernburger Maschinenfabrik, Bernburg.
Zeitzer Eisengiesserei und Maschinenfabrik Actein-Gesellschaft, Zeitz.
Roehrig und Koenig, Magdeburg.
Buckauer Maschinenfabrik, Magdeburg.

All of these firms are prepared to furnish information and submit estimates to interested parties free of charge.

Some of the presses and apparatus for drying are partially patented, but the systems in general are not patented.

The Bernburger Maschinenfabrik, above mentioned, manufactures drying apparatus according to the system Schulz.

As of possible interest in this connection, I may mention that a patent has recently been applied for in the United States, as well as in Germany and Austria, by Mr. Schwarz, of this consular district, for the manufacture of briquettes[a] out of poor and otherwise useless

[a] Sample of which has been filed for reference in Bureau of Foreign Commerce.

coal with the aid of a very cheap, in fact almost worthless, binder. It, is claimed that briquettes made according to this system emit no unpleasant odor while burning; they give out a great deal of heat; the binder is not destroyed either by water or high temperature, and the process of manufacture is extraordinarily simple.

Director Max Salzmann, of the Buckauer Maschinenfabrik, has also recently applied for a patent in the United States for improvements in briquette presses.

WM. A. MCKELLIP, *Consul.*

MAGDEBURG, *January 27, 1903.*

MAINZ.

Briquetted fuel has long been used in Germany, with results eminently satisfactory, both on account of its lower price and its greater heating value as compared with the coal from which the briquettes are made. The heating value of the latter is from 10 to 15 per cent greater than that of the coal, while their wholesale price f. o. b. only ranges from but 11 to 12 marks per metric ton of 1,000 kilos ($2.62 to $2.86 per 2,200 pounds). The wholesale price at Mainz, exclusive of octroi duty, is from 15.50 to 16 marks ($3.69 to $3.81) per metric ton, while the retail selling prices, delivered at the house in this city, including octroi duty, runs from 23 to 25 marks ($5.47 to $5.95) per metric ton.

The cost of production, which it was impossible for me to ascertain, depends largely upon the cost of coal pitch, which is used as a binding material. The price of the pitch has steadily increased during the past few years, and is to-day quoted at 80 marks ($19.04) per metric ton.

Briquetted fuel is manufactured from bituminous coal (anthracite can be used only in combination with bituminous coal, as the former does not ignite readily), lignite, and peat. The last two materials are, however, little used, and, owing to their inferior value, only in the immediate neighborhood of their production. Lignite is mined in a similar manner to ordinary coal, while peat is dug from peat bogs. Both products are dried by exposing them to the air.

The coal best adapted for the manufacture of briquetted fuel is of a semibituminous character, very similar in quality to Nixon's steam navigation coal, and burns with a long flame and an exceedingly small amount of smoke and soot. Only coal dust and the finer grains of coal, under one-half inch in diameter, are used. Both are carefully cleaned from all impurities and then ground fine. As a binding material coal pitch, produced from coal tar, has proved most satisfactory. The briquettes are pressed into the required shape by machinery under a pressure of 200 atmospheres.

Briquetted fuel is usually made in the following shapes and sizes:

1. In oblong bricks, 220 by 110 by 105 millimeters (about 8⅝ by 4⅛ by 4 inches), each weighing about 3 kilos (6.6 pounds).
2. In oblong bricks, 280 by 150 by 110 millimeters (about 11 by 6 by 4⅜ inches), each weighing about 5 kilos (11 pounds).
3. In square bricks, 160 by 160 by 105 millimeters (about 6⅛ by 6⅛ by 4 inches), each weighing about 3 kilos (6.6 pounds).
4. In two sizes of egg-shaped bricks weighing, respectively, about 35 and 125 grams (1¼ and 4½ ounces).

Owing to the presence of coal pitch in briquetted fuel, the latter is more readily ignited. It also develops steam more rapidly than ordinary coal.

According to experiments carried out at the Imperial dockyards at Wilhelmshaven, 1 kilo (2.2 pounds) of good quality of briquettes converted 9 kilos (19.8 pounds) of water at 0 degree centigrade (+ 32 degrees Fahrenheit) into steam.

The incombustible residuum is, according to the quality of the briquetted fuel, from 6 to 10 per cent less than from coal, and the slag is readily removed.

The introduction of coal briquettes for railroad purposes at first met with serious opposition on part of the engineers and firemen, owing to the dust caused by breaking up the fuel, but now that their manufacture has been vastly improved, briquettes are used largely on all railway lines.

Briquetted fuel may be stored in the open air for many years without deteriorating in quality, the coal pitch protecting it from dampness. Spontaneous combustion is impossible. Coal briquettes, when properly stored, require 20 per cent less room than the same weight of coal.

They are not affected by tropical heat and are well adapted for use on railroads and steamships, in ironworks, sugar factories, glass works, furnaces, porcelain and cement works, and for domestic and many other purposes.

The following figures show the production and home consumption of briquetted fuel in Germany during the year 1900:

Description.	Production.	Home consumption.
Bituminous briquetted fuel.	*Long tons.*	*Long tons.*
Rhineland and Westphalia	1,546,816	1,426,416
Saxony	8,500	8,500
Aix-la-Chapelle region, about	15,000	15,000
Middle and Upper Rhine	400,000	400,000
Total	1,970,316	1,849,916
Lignite briquetted fuel.		
Cologne region	930,000	783,910
Saxony	95,000	95,000
Total	1,025,000	878,910

Of the total production—2,995,316 tons, of 2,200 pounds—2,728,826 tons were consumed at home and the remainder either exported or used by steamships.

The "Maschinenbauanstalt Humboldt," in Kalk, near Cologne, manufactures briquette presses, while the bituminous briquetted fuel itself is produced as a by-product by the following mining companies:

Zeche Altendorf, Dahlhausen a. d. Ruhr.
Aplerbecker Actien-Verein für Bergbau.
Zeche Baaker Mulde, Linden a. d. Ruhr.
Zeche ver. Birkefeld Tiefbau, Aplerbeck.
Zeche Blankenburg, Hammerthal a. d. Ruhr.
Zeche Bommerbaenke Tiefbau, Bommern.
Zeche Caroline, Holzwickede.
Zeche ver. Dahlhauser, Tiefbau, Dahlhausen a. d. Ruhr.
Zeche Actien-Gesellschaft, Zeche Dannenbaum, Bochum.
Zeche Eiberg, Steele.
Zeche Eintracht, Tiefbau, Steele.
Zeche ver. Engelsburg, Bochum.
Zeche Freie Vogel und Unverhofft, Hoerde.
Zeche Fröhliche Morgensonne, Wattenscheid.
Zeche Gottessegen, Loettringhausen.
Zeche Hamburg und Franziska, Witten.
Zeche Harpner Bergbau-Actien-Gesellschaft, Dortmund.
Zeche Herkules, Essen.
Zeche Johann Deimelsberg, Steele.
Zeche Julius Philipp, Bochum.
Muehlheimer Bergwerks-Verein, Muehlheim a. d. Ruhr.
Zeche Lothringen, Gerthe, near Bochum.
Zeche ver. Poertingsiepen, Kupferdreh.
Gewerkschaft ver. Rosenblumendelle, Muehlheim.
Zeche Schuerbank und Charlottenburg, Aplerbeck.
Zeche Siebenplaneten.
Zeche Steingott, Kupferdreh.
Zeche Victoria, Kupferdreh.
Zeche ver. Wiendahlsbank, Annen.
Zeche Alte Haase, Sprockhoevel.
Zeche Hoffnungsthal, Sprockhoevel.

All of the above companies, except the last two, form a trust and effect their sales through a joint sales agency at Dortmund, known as "Bricket-Verkaufs-Verein zu Dortmund."

The most important lignite briquette manufacturers are located in the neighborhood of Liblar, near Cologne, and effect their sales through a joint sales agency at the latter city, known as "Briketts-Verkaufs-Verein Coeln."

The lignite mining company "Friedrich," at Hungen (Ober-Hesse), also manufacture lignite briquettes.

WALTER SCHUMANN, *Consul*

MAINZ, *November 28, 1902.*

MANNHEIM.

The manufacture and use of briquettes for fuel in this part of Germany extends over a period of from twelve to fifteen years and is rapidly increasing. It is stated that during 1902, their production was almost 100 per cent greater than in any previous year. About 500,000 metric tons (of 2,204 pounds) of briquettes were made last year by the several local factories, the four largest of which have a total combined capacity of about 1,700 tons a day. The best equipped and most important of these factories has a capacity of 500 tons per day of eleven working hours. This plant is admirably located on two Rhine harbors of this city and is operated in connection with the largest local wholesale coal yard. This concern has an extensive power plant and excellent facilities for unloading coal from river barges and for storing and handling it. Its briquette plant may be taken as embodying the latest methods for the manufacture and handling of fuel briquettes in this locality. To the courtesy of its managing director I am indebted for a visit to the plant and for most of the facts herein given.

METHODS OF MANUFACTURE.

The process of manufacture is not complicated and consists essentially in thoroughly mixing fine coal with coal-tar pitch under temperature sufficient to melt the pitch, and in pressing the heated mass into briquettes of the form desired. The coal used, which forms from 90 to 92 per cent of the briquettes, is mainly fine soft or bituminous. To some extent, anthracite is used with soft coal, and this combination produces a briquette of superior quality. This fine coal is not coal dust merely, but is the very fine coal residuum from the several processes of sifting to which coal is subjected in Germany. Only such coal is used for briquettes as will pass through a 10-millimeter screen. This coal is known to the trade as "Gries." In the process of mining and handling the grades of soft coal sold in this market it is stated that from 35 to 40 per cent of gries is produced. My informant states that the demand for this product for briquette manufacture is so large that the price at the mines has risen greatly during the past few years, being at times from one-half to two-thirds the price of screen coal.

The binding ingredient in the briquettes manufactured in this district is the ordinary coal-tar pitch of commerce, the residuum of coal tar after the valuable oils have been removed by distillation. At this season of the year, February, it is hard and must be handled with pick and shovel. It is ground in a mill of simple construction, and is carried by a system of elevators to a point where it is met by a corresponding stream of fine coal. The mass is then passed into a receptacle where steam at high temperature is admitted and the coal and pitch are thoroughly mixed, the heat from the steam melting the pitch

and at the same time removing any water that may be in the coal. This receptacle is referred to as a drying apparatus, though it is a mixing apparatus as well. Different forms of dryer are used, the most common kind consisting of a large hollow cylinder or drum revolved by means of gearing and fitted with a series of narrow shelves running lengthwise on the inner surface of the cylinder, for facilitating the process of mixing as the cylinder turns. As one end of the cylinder is higher than the other, the contents tend to work from the end where they are admitted to the point of egress at the other end. The largest dryer in use at the factory visited is nearly 50 feet long and about 6 feet in diameter.

After the process of drying and mixing has continued for a few minutes the hot mass, now called "Brei," passes to the powerful presses, where it is rapidly pressed into the form of briquettes.

These presses are of different pattern. All are heavy machines operated by steam, and each has a capacity of from 10 to 15 tons an hour. From the presses the briquettes are carried by elevators to the cars, where they are loaded. From the time the coal and pitch enter the building until they are in the form of finished briquettes is about ten minutes. Each process is performed by machinery.

No claim is made that the methods used in this factory are patented or secret, though a part of the machinery is protected by patents. Two forms of presses are recognized. They are known as the system Coufinall of Messrs. Schüchtermann und Krämer, Dortmund, Westfalia, and the system Tigler and Surmann, of Machinenbau Actien-Gesellschaft vormals Tigler, Meiderich, Rheinland.

The dryers specially recommended are the Trockenöfen of Schüchtermann und Krämer, Dortmund, Westfalia, and the Trockentrommel manufactured by Petry und Hecking, of Düsseldorf.

The briquettes made in this district are of two sizes, weighing 2 kilos (about 4½ pounds) and 10 kilos (about 22 pounds), respectively. The smaller kind is much more popular in this part of Germany, while in Switzerland the larger briquette is preferred. From 30 to 50 per cent of the fuel used on the State railways of Baden in 1902, and from 70 to 80 per cent of that used on the Swiss railways in the same year, are said to have been briquettes. For firing locomotives special advantages are claimed for this form of fuel, because of the ease with which it is handled and stored on the tenders and in the railway yards.

PRICES.

The cost of manufacture is dependent to some extent on local conditions and the equipment of the plant. It is stated to be from 12 to 15 marks (from \$2.96 to \$3.57) a car of 10 tons. This includes loading on the car. The present price of briquettes in this district to railways and factories is about 16 marks (\$3.81) a metric ton (2,204.6 pounds).

NOTES.

It is not claimed for briquettes that they have the heating value of good screen coal, but that they utilize in a convenient manner a large amount of fine coal which otherwise is almost valueless.

It is stated that briquettes do not lose in quality by exposure to the weather. At the plant above referred to there is a pile of 60,000 tons of briquettes which has been exposed to the weather for two years. These briquettes are kept in stock in the event of strikes or of some unusual demand for coal. They show no signs of disintegration.

The limited supply of coal-tar pitch to be had and the fluctuations in the price of this product have led to trials of other binding materials for briquettes. Trials have been made with rosin and other ingredients, but with indifferent success. At this time pitch is looked upon as the only available material having the qualities required.

H. W. HARRIS, *Consul.*

MANNHEIM, *February 6, 1903.*

STETTIN.

There are only three plants manufacturing briquetted fuel in this consular district (embracing the provinces of Pomerania, West and East Prussia, and part of Posen). One of them, the "Hedwigshuette Anthracit-, Kohlen-, und Kokes- werke, James Stevenson, Actien-Gesellschaft," is located near Stettin, on the Oder River; another, the "Dominium Langenberg, F. Peters," at Langenberg, is also in the vicinity of this city, while the third, the "Königsberger Kohlen-Import und Steinkohlen-Briket-Fabrik, Actien-Gesellschaft," is at Königsberg, in Prussia, on the river Pregel.

AMOUNT MANUFACTURED.

The Hedwigshuette manufactures about 50,000 tons of briquetted fuel per annum, and gives continuous employment to from 30 to 50 persons. It is said that this company could greatly increase its output, the demand being greater than the supply. The Dominium Langenberg produces, it is estimated, from 7,000 to 8,000 tons annually. The Köningsberg plant the first year of its existence (about seven years ago) manufactured nearly 50,000 tons of briquettes, but as only 25,000 tons was disposed of, its output since that time has been quite irregular.

MATERIALS USED.

The Hedwigshütte makes briquetted fuels from coal dust, both bituminous and anthracite; the Königsberg company from dust of bituminous coal only, while the Peters, at Langenberg, utilizes peat alone.

All lignite briquetted fuel is shipped here from the southern provinces of Silesia, Saxony, etc. As bonding material for hard-coal briquettes coal pitch is used.

SIZE AND WEIGHT OF BRIQUETTES.

Briquettes from lignite coal average 28,000 to the carload (22,000 pounds), while the average of the so-called "Heiz-briquettes" for domestic use, produced at Königsberg and, to a smaller extent, at the Hedwigshütte, from dust of bituminous coal, is 98 briquettes to a centner (117.5 pounds). Most of the James Stevenson Company's product consists of hard-coal briquettes weighing, respectively, 6 and 3 pounds German (6.6 and 3.3 pounds). They are used for heating boilers of factories and by the smaller-sized locomotives.

METHODS OF MANUFACTURE—MACHINES USED.

In regard to the method of manufacturing briquetted fuel from turf and the kinds of machinery used, I would refer to the report of Consul John E. Kehl, of this city, dated October 26, 1898, and printed in Consular Reports of same year,[a] which covers the subjects thoroughly. It is almost impossible to secure information relative to the production of briquettes from coal dust, as managers of the factories refuse to give any details. The name of the firm that furnished the machines for the Königsberg plant is "Zeitzer Eisengiesserei, Maschinenbau-Actien-Gesellschaft," at Zeitz, Germany, which company, however, refused to give information or even to send a catalogue.[b] I suppose that the machines of the Stevenson concern are now of the same make; formerly, it used patented machinery (Koopmann system), but the cost of manufacture was too great.

SELLING PRICE.

For the reason above given, it is impossible to state the cost of production. The selling price for hard-coal briquettes of the larger sizes (3 and 6 pounds) is about 17 marks ($4.05) per ton, while for the smaller-size Heiz-briquettes it is 90 to 95 pfennigs (22 to 23 cents) per centner (117.5 pounds). Lignite briquettes are retailed at 85 pfennigs (20 cents) per centner.

The heating value of all kinds of briquettes is less than that of English coal. Briquetted fuel made from coal dust is unpopular, as it produces—owing, perhaps, to the binding material—a good deal of soot. Lignite briquettes, however, are in general use.

HENRY HARDER,
Vice and Acting Consul.

STETTIN, *December 10, 1902.*

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[a] Advance Sheets, No. 278, November 19, 1898 (Monthly Consular Reports, No. 220, January, 1899). The information contained in this report is covered by reports published in this series.

[b] See page 86.

NETHERLANDS.

AMSTERDAM.

No briquetted fuel made of coal dust or lignite is manufactured in this consular district. The briquettes used in the Netherlands are imported from Germany (Westphalia) and Belgium.

There is, however, in this country one factory that produces peat briquettes, and has an output of about 100 tons a day. But this fuel is comparatively new, and I am told the plant is not yet operated on a paying basis.

The selling price of the briquetted peat is 5 florins ($2.01) a ton at the factory, whence to Amsterdam the freight rate is $1.

The price of the imported coal-dust briquettes is 95 florins ($38.19) per 10 tons c. i. f. Amsterdam, and of the imported brown-coal briquettes, 85 florins ($34.17). Coal per 10 tons c. i. f. Amsterdam is quoted at 82.50 florins ($33.17).

These peat briquettes are manufactured by the Griendsveen Mosslitter Company, Limited, of Rotterdam.

Briquettes are used by the State Railway, the Netherlands Central Railway, and the waterworks, and also for household purposes.

FRANK D. HILL, *Consul.*

AMSTERDAM, *January 23, 1903.*

ROTTERDAM.

There are no statistics available from which the quantity of briquetted fuel manufactured and used can be ascertained, and neither the manufacturers nor the importers of such fuel are disposed to furnish information in reference thereto; in fact, the majority of parties interested in the article decline to give any particulars at all.

The briquetted fuel industry of this country is as yet in its infancy and of little importance; still it promises, owing to the large area of peat soil in the Netherlands, to become one of the principal industries. The aggregate area of the peat fields is 126,152 acres, with a probable average depth of 10 feet. Some briquetted fuel is prepared from charcoal mixed with lime, but as these raw materials are not produced in the Netherlands, and as that fuel has to compete with a superior article imported from Germany (where charcoal, as a by-product of the chemical factories, can be purchased very cheaply), it is the general opinion that the charcoal-briquette industry is not a success here.

PEAT BRIQUETTES.

The manufacture of peat briquettes in the Netherlands has been inaugurated by the Griendtsveen Mosslitter Company, Limited, which owns a large area of peat fields and seems to be very successful.

This company, to which I am indebted for much of the information contained in this report, has informed me that briquettes are prepared from peat without any other material being added. The cost of manufacture can not be stated, as the manufacturers claim it depends entirely upon the situation and condition of the peat fields whence the raw material is derived. The wholesale price of peat briquettes is $2 per ton delivered on barge or truck at the works.

The method of manufacture is very simple. The peat is dried in the open air, being manipulated frequently, in order to eliminate as much moisture as possible. It is then sent to the peat mill, ground and again dried on large steam furnaces, freed from fiber, and pressed into small blocks under such high pressure that the material becomes solid without the addition of any binding substance. The presses used in the peat-briquette industry are supplied by the Dusseldorfer Eisenwerk Actien-Gesellschaft, at Dusseldorf, Germany.

The daily and also the maximum output of the plant is 100 tons. With well-constructed plants very little hand labor is required.

The plant is situated at Griendtsveen, Helenaveen Station, near Helmond, province of North Brabant.

As no patent law exists in the Netherlands the methods, processes of manufacture, and machinery are not patented in this country. The trade-marks of briquettes may, however, be registered and thus protected against imitation.

The heating value of peat briquettes is 5,000 calories. They have about five-sevenths of the heating capacity of average bituminous coal.

The following appeared in the Netherlands periodical, De Turf en Steen Industrie (The Peat and Stone Industry), in 1902:

PEAT AS FUEL FOR LOCOMOTIVES.

On the railroad from St. Petersburg to Warsaw, tests have been made with pressed peat as fuel for locomotives. A freight train consisting of 30 cars drawn by a locomotive using this fuel has covered the distance between St. Petersburg and Luga (about 84 miles) in the prescribed time. The fuel is now being used in the locomotives of passenger and express trains.

COAL BRIQUETTES.

The greater part of the charcoal and all the bituminous, anthracite, and brown coal briquettes used in the Netherlands are imported—the charcoal briquettes from Germany, and the coal briquettes principally from Germany but also from Belgium. No statistics exist as to the quantity imported.

Coal briquettes can be stored almost anywhere, even in the open air, for long periods without the quality or weight suffering in the least. They are not self-igniting, and they take up 20 per cent less room than the same weight of coal.

The average price for coal briquettes is: For bituminous coal, 9.25 florins (or $3.70) per 1,000 kilograms (2,204 pounds); for brown coal, 11.11 to 12.50 florins ($4.40 to $5) per 1,000 kilograms.

CHARCOAL BRIQUETTES.

These are manufactured on a small scale in the Netherlands by F. W. Hisschemöller & Son, Rotterdam; Elferink & La Roy, Vriezenveen; Asselbergs & Son, Bergen op Zoom; Nagtegaal & Son, Alfen on the Rhine; Minke & Kappert, Dedemsvaart.

The average price is from 16 to 17 florins ($6.40 to $6.80) per 1,000 kilograms (2,204 pounds).

S. LISTOE, *Consul-General.*

ROTTERDAM, *March 10, 1903.*

NORWAY.

CHRISTIANIA.

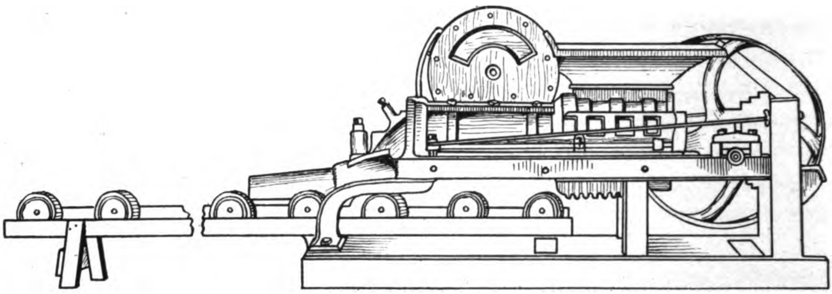
Coal has not as yet been discovered in paying quantities in any part of Norway, but peat of the best quality is found in abundance, and in some places is the only fuel used for domestic purposes. It is generally obtained in the old-fashioned way—cut with a spade, by hand, and in pieces about 12 inches long, 8 broad, and 3 thick. These pieces are placed diagonally in pairs on the ground in the open air, tops touching and bases apart, and in this manner dried, being frequently turned so as to expose all sides to the wind and sun. Sometimes they are also dried on rocks, where the latter are conveniently at hand. When properly dried the peat is carefully piled in heaps, each heap holding from a half ton to a ton and a half, and later, at convenience, hauled to sheds or storehouses for use as needed. The time and labor spent in the work is considerable. It is, however, attended to in the summer, at times when no other occupation is neglected. Much of the peat is dug by women and children.

During the last thirty years, there have been many fruitless attempts in different localities to utilize the peat bogs in a more economical manner. Of late, however, through the introduction of improved machinery, better means of communication, and better understanding of conditions, more satisfactory results have been obtained.

A society counting many prominent Norwegians as members has been formed for the specific purpose of utilizing the peat bogs, which in this country cover an area of about 10,000 square kilometers (3,861 square miles). The quantity and quality of the peat vary much, of course, in the different bogs, but some of the deposits are of the best quality and exceed 12 feet in thickness.

Peat briquettes are made and burned in several factories located where peat is easily obtained. The machinery used is built principally on the Anreps system; some is imported and some made at the machine shops of Aadals and Hasle Brug. Of the latter I give below illustrations and descriptions.

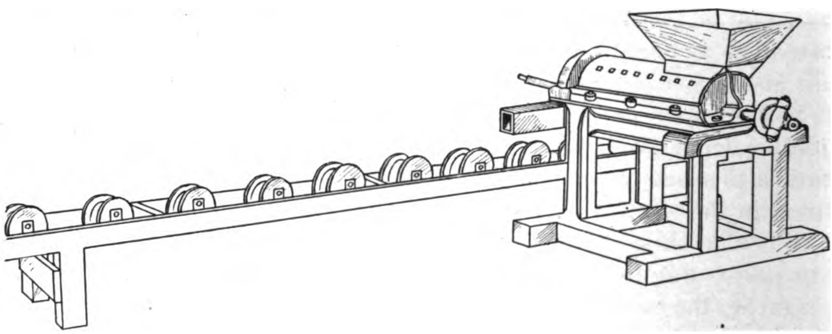
The product of these machines is known as "pressed peat." The



Peat making machine, No. 1. (Steam power.) 4 horsepower.

This machine requires a crew of 6 men, 8 women, and 2 boys. It delivers 20,000 pieces of peat per day. Its cost is 400 kroner ($107).

process is quite similiar to that of brickmaking. The peat is dug from the bog and put into the machine, where it is ground, and then forced through a square spout out upon a moving platform, where it is cut into convenient lengths. Thereafter it is dried, either in the open air or artificially, until its volume of moisture is reduced to 20 to 25 per



Peat making machine, No. 2. (Horse power.) 2 horses.

This machine requires a crew of 3 men and 5 boys or women. It produces 8,600 to 10,000 pieces of peat per day. Its cost is 350 kroner ($93).

A similar machine of smaller dimensions sells for 175 kroner ($47),

cent. It is estimated that 1.8 tons of pressed peat equals 1 ton of soft coal, for heating purposes, while a ton of peat made in the old way, by hand, equals only about one-third of a ton. The total cost of cutting, drying, and storing the peat will not, under ordinary conditions, exceed $1.60 per ton.

Attempts have also been made to manufacture coke from peat, and

a plant for that purpose was built at Stangfjord, in the neighborhood of Bergen. The heating was effected by an electric current, the power for which was taken from a waterfall in the vicinity. Each kiln was loaded with 400 to 500 kilograms (881.8 to 1,102 pounds) of dried machine-made peat, and the coking required three to four hours. The electric current was of 500 amperes, with a tension of 40 to 50 volts; the temperature in the kiln was about 570° F. The coke was rather compact and burned with a bright flame—it was well suited for domestic purposes—and sold at Bergen for about $4 per metric ton. The plant, however, has for some reason shut down. A full description of this plant appears in the Scientific American of October 11, 1902, on page 237.

Peat in one form or another will, beyond doubt, gradually become more and more used for many purposes. Its production and utilization is at present in a more advanced stage in Russia, Denmark, and Sweden than in Norway. The pressed machine-made peat is, in all probability, the article which will prove of most value in the future. Peat is the only briquetted fuel used in Norway.

HENRY BORDEWICH,
Consul-General.

CHRISTIANIA, *December 20, 1902.*

SUPPLEMENTARY.

The question how to best utilize the vast Norwegian peat bogs is receiving much attention. After extensive experiments, experts have come to the conclusion that plants for carbonization of peat, where it is transformed into coke or coal, must be looked upon as failures. The cost of effecting the transformation is too great, and there is too much waste of material. Common hand or machine made peat is acknowledged to be the most promising article, and several manufacturing plants are now using it. To find the cheapest and best mode of preparation is the question.

For the purpose of studying the methods practiced in other countries, the machinery employed, cost of production, etc., the Government, in the year 1901, sent an agent to Sweden, Denmark, Germany, the Netherlands, Austria, and Russia. He has gathered much valuable information, as appears from a pamphlet just published, in which he gives an account of his experiences in the first-named countries. His report from Russia will appear at some future date.

I send under separate cover the pamphlet above mentioned.[a]

HENRY BORDEWICH,
Consul-General.

CHRISTIANIA, *March 13, 1903.*

[a]The pamphlet (in Norwegian) is filed for reference in the Bureau of Foreign Commerce.

BERGEN.

Norway possesses an abundance of excellent peat. These deposits are, however, as yet practically untouched, which is remarkable, as the prices paid for anthracite and soft coals are high. The reason, however, why peat has been so little used in this country may be explained by the fact that the methods heretofore applied for carbonizing it were too costly. At present, it is too early to give any exact figures as to the amount of briquetted peat fuel manufactured and consumed annually, although it can be stated that the industry is gradually being developed.

Herr P. Jebsen, of Dale, Norway, has invented a process for carbonizing peat, which is said to be advantageous. It has been in operation during three years in peat-charcoal works at Stangfjord, which, I am told, are now closed on account of lack of sufficient capital.

The partially dried peat briquettes are, in accordance with this method, carbonized in hermetically closed retorts by electrical heat. Several retorts can be heated at the same time with one dynamo machine. The dynamos are driven by water-power turbines, and the process allows the peat blocks to be carbonized within a short time and with great uniformity, while the peat charcoal produced consists of a dense black mass, showing the structure of peat. In broken condition, the specific gravity of the carbonized fuel is about 0.3 and the theoretical calorific value 7,000 to 7,500 thermal units. It burns excellently, yielding but little soot, and gives a rapid and strong heat. The ash does not retard combustion as do the ashes of lignite and coals.

Following is an analysis of this fuel from the Royal Norwegian High School at Christiania:

	Per cent.
Carbon	76.91
Hydrogen	4.64
Oxygen	8.15
Nitrogen	1.78
Sulphur	.70
Ash	3
Moisture	4.82
Total	100

The power for carrying out the treatment at Stangfjord is derived from five 80-kilowatt dynamos coupled direct to five turbines. This part of the plant was installed by Schuckert & Co., of Nuremberg, Germany. By the aid of mechanical power, the boats are discharged and the peat submitted to the first drying and pressing operation. This is performed in a 5-horsepower press which can burn out about 2,500 blocks of peat per hour. The weight of the dried peat in these blocks is about 4.4092 pounds. The partially pressed and dried peat

briquettes are next loaded into trolley shelf wagons, each carrying 140 briquettes placed on ten shelves. When loaded, these wagons are pushed into the cooler end of the drying tunnel.

The air draft passing through the tunnel is heated by the waste gases from the retorts and set in motion by the means of electrically operated fans. At the top end of the tunnel, where the wagons emerge, the temperature of the air is 90° to 100° C. and at the lower end where they enter, 40° to 50° C. The peat is thus submitted to a gradually increasing temperature as the wagons pass up the tunnel. The loads of dried peat are next taken on tram rails direct into the retort house and emptied into the retorts. One hundred and two shelf wagons, two tunnels, three electric fans, and one hot-air stove composed the drying plant at Stangfjord, which is said to have been able to produce 1,000 air-dried peat blocks a day.

The retorts consist of upright cylindrical vessels of iron, about 6 feet 6 inches in height and 3 feet 3 inches in diameter. Each retort is provided with a removable cover, a discharging hole below, gas exit pipes, and a pressure gauge. The retorts have spiral resistance coils, so constructed that the peat blocks can be built up in contact with them until a pigeon-holed mass of peat entirely fills the retort, in the center of which the heating agent lies. The top cover of the retort is now clamped down and the electric currents turned on. When submitted to this electrical process in closed retorts, the peat will yield three products. Openings in the retort cover allow the exit of the gaseous products, which are used for heating the air in the drying tunnels.

After this carbonizing operation has been completed, the remaining peat fuel is allowed to cool down to 130° C. The retort is then opened and the peat discharged into wagons.

Before the Stangfjord factory was closed its products were sent to Bergen, where they are said to have been in great demand.

At present, there is but one peat plant in operation in this consular district, the name of which is Fedje Forvbrug. It is located at Fedje and is a small concern started a short time ago. Its products are sent to this city and retail at about kroner 1.10 ($0.29) per hectoliter (2.838 bushels). I bought a few sacks of these briquettes for trial, but they are poorly made, the process being no improvement upon that in use about thirty years ago, when the same kind of fuel (torv), although superior, was bought from the farmers of Sweden.

VICTOR E. NELSON, *Consul.*

BERGEN, *January 15, 1903.*

SPAIN.

BARCELONA.

The manufacture of briquetted fuel in Spain is centered in the province of Asturias. It is estimated that about 165,000 tons of briquettes are produced annually, the whole of which is consumed in this country. They are made from washed small coal, either anthracite or bituminous, according to the location of the works; the greater portion is, however, semibituminous.

With regard to the cost of production the ton, I find that the works which use small coal from their own collieries roughly estimate it as follows:

Description.	Spanish currency.	United States currency.
	Pesetas.	
Small washed coal delivered at works	9.00	$1.35
Pitch (as an agglomerant)	1.80	.27
Labor	1.60	.24
Interest and amortization	1.80	.27
Total	14.20	2.13

The present nominal price is 20 pesetas (about $3) the ton. There is, however, little if any sale of the product in the open market, as Spanish briquetted fuel is unable to compete with that of British manufacture; its consumption is confined to the railroad companies, under contracts.

The method of manufacture is as follows: The coal, after being washed, is run through crushing rollers and ground fine; it is then passed into hoppers, together with the necessary proportion of pitch, whence, after being treated by steam, it is fed automatically into the presses. The only agglomerant employed is pitch, which is principally imported from Great Britain. Neither lignite nor peat is used for briquettes. Lignite is not found in Asturias, and though there are extensive peat beds in the country, they remain untouched, owing to the lack of transport facilities.

Following is a list of the existing works:

1. Sociedad Carbonera de Lena—La Cobertoria, at Pola de Lena; uses anthracite coal and the Dupuys system of machinery; has a daily output of 30 tons, with 5 men employed for each machine. The briquettes made weigh from 2 to 15 pounds. This concern works exclusively for the Andalusian Railroad Company.

2. Sociedad Hullera Española, of Ujo; owns two works with Bouriezs system; uses semibituminous coal; sells chiefly to the North of Spain Railroad Company. Its output amounts to about 125,000 tons per annum.

3. Sociedad Hullera del Turon, of Turon; employs the Bietriz-Couffinhal system; uses semibituminous coal; has an annual output of about 20,000 tons.

4. Sociedad Fábrica de Mieres, at Mieres; employs the Mazeline system; uses bituminous coal; manufactures briquettes solely for its own locomotives and boilers.

5. Sociedad Pola & Gilhou, at Gijon; employs the primary English system; uses bituminous coal; manufactures briquettes exclusively for the Langreo Railroad Company.

JULIUS G. LAY, *Consul-General.*

BARCELONA, *February 21, 1903.*

MALAGA.

Briquetted fuel, in the accepted meaning of the term, is not manufactured in this consular district. It is secured elsewhere and is used by the French railroad operating in the provinces of Malaga, Granada, Jaén Cordova, Seville, and Cadiz. The director of the railroad company informs me that in Malaga city, between 75,000 and 80,000 tons of coal are consumed annually, of which 20,000 tons are briquettes. This fuel is manufactured by the Sociedad de Explotacion de las Minas de Belmez, province of Cordova. The mines at that place and the adjacent briquetting plant are owned by the railroad company. The Cordova plant is by far the most extensive in this vicinity, and it furnishes briquetted fuel for the entire southern section of Spain.

A composition that may be construed as a form of briquetted fuel is manufactured and used extensively in Malaga. It is known as "Paris coke," and is becoming so popular that within the past few years, two local plants have sprung into existence to compete with the one manufacturer who had heretofore enjoyed a monopoly of the trade. This fuel is composed of a mixture of 90 per cent of charcoal and 10 per cent of coke, to which is added 7 per cent of pitch. The mass is then molded by what is termed a "compressed-coal machine," which produces circular briquettes 3½ inches in length and 1 inch in diameter.

The process of manufacturing "Paris coke" differs but little in the local plants, and the cost is much the same—12 pesetas (about $1.70) for 92 kilos (202.82 pounds). It is also retailed in small quantities at one-sixth of a cent a brick.

The three local manufacturers are Miguel Muñoz, Manuel Molina Lugue, and Alberto Garcia Gutierrez. The first is the leader in the trade in Malaga, the output of his plant for the past eight months being 1,840 kilos (4,056 pounds) per diem. The others produce less.

The machines used are of French manufacture and are capable of pressing 10,000 kilos (22,064 pounds) in twelve hours.

"Paris coke" is sold almost exclusively to the poorer residents of Malaga, who use it for cooking purposes. It is cheaper than charcoal, the only other commodity employed in cooking, but the one strong objection to it is that while its heating property is lasting, it is a trifle too solid to ignite quickly. The bricks are not used for heating purposes, nor is any other fuel for that matter, the people seemingly being content to live in damp stone houses during the short winters without fire of any kind.

This form of fuel has not as yet been utilized by industrial establishments.

D. R. BIRCH, *Consul.*

MALAGA, *January 21, 1903.*

SWEDEN.

GOTHENBURG.

The manufacture of briquetted fuel in Sweden has not yet passed from the experimental stage, and therefore does not appear in any official statistics. Consequently it is impossible to state the quantity produced, number of workmen employed, amount of money invested, cost of manufacture, or price of the finished product.

Peat is the chief raw material that could be used for briquette making in this country, and of late years the Government, and private individuals, have paid much attention to the problem of utilizing it in some form or other as fuel for factories and railroads. The results of these official experiments have not, however, been made public.

Sawdust, also, has been considered as a raw material that might with success be used for briquetting purposes. But it is said that such briquettes, on account of their density, do not burn readily.

In making coal briquettes, the coal is pulverized, refined, and then pressed into blocks. The Government factory is located at Elmhult. Its annual production is only about 30,000 tons, while the State railroads consume nearly 550,000 tons of coal per year.

The peat briquettes mostly used in Sweden are what might be called a half-manufactured product—that is to say, the wet peat is by simple machinery cut up into pieces about the size of small bricks and then air dried. The price of this fuel in Gothenburg is about 17 cents per hectoliter (2.838 bushels).

Swedish inventors have also endeavored for several years past to produce charcoal from peat, but apparently without economical results.

One of these inventors is an engineer, C. E. Laurenius, of this city. With regard to the peat coal produced by his process, I append translation of an analytic statement from the Royal Technical High School at Stockholm. As regular manufacture on a large scale has not been started, the market price of this coal can not be stated.

I beg to close this report by quoting an article printed in Göteborgs Aftonblad November 29, 1902, of which the following is a translation.

Engineer Alf Larsson, at a meeting of the Association of National Economy at Stockholm, yesterday gave a lecture upon the use of our peat bogs. He said in part:

"Russia yearly produces 4,000,000 tons of peat, and the Russian Government receives $938,000 per annum for leasing peat bogs. Germany produces 2,000,000 and Holland 1,000,000 tons. Austria, Denmark, Iceland, and other European countries also utilize their deposits of this cheap fuel. Here in Sweden, the production of peat for fuel is about 1,000,000 tons a year.

"Peat can be recommended as a very good fuel, and its preparation gives employment to many persons in this country. Near Falköping, for instance, about 1,000 persons are each summer employed in the industry. Peat can also be utilized as fuel by the paper mills, glassworks, ironworks, brickkilns, and especially in the households. The Government engineer for the peat industry estimates the supply of peat in Sweden to be 4,000,000,000 tons. The peat question is at present the most important problem in Sweden. The Government has done some experimenting in the matter, with good results, but very much remains to be accomplished. * * * If the production of peat in Sweden amounted to 5,000,000 or 6,000,000 tons per annum, and the peat were duly recognized and used as a fuel, it would directly or indirectly bring this country a yearly profit of $26,800,000."

ROBERT S. S. BERGH, *Consul.*

GOTHENBURG, *January 10, 1903.*

MATERIAL-TESTING DEPARTMENT OF THE ROYAL TECHNICAL ACADEMY.

[Certificate No. 3223. Samples Nos. 17040-17043.]

Testing of the chemical composition and heating amount. Testing objects: One sample of peat, 3 samples of peat charcoal. The samples arrived October 18, 1901.

The tests have given the following results:

Composition.	Peat, No. 17040.	Charcoal.		
		No. 17041.	No. 17042.	No. 17043.
Moisture ... per cent	11.8	2.12	2.62	1.74
Dry substance:				
Carbon ... do	54.4	60.40	63.10	87.30
Hydrogen ... do	6.18	5.06	5.15	4.22
Oxygen and nitrogen ... do	34.10	32.10	28.00	4.02
Sulphur ... do	...	...	.08	.10
Ashes ... do	5.32	2.44	3.67	4.26
Total ... do	100	100	100	100
Percentage of phosphorus in the ashes ... do	...	...	2.23	2.31
Heating power per kilo, dry substance ... calories	5,280	5,830	6,020	7,410
With regard to the coaling the following data have been given by the sender:				
Outturn of charcoal ... per cent	...	91.2	83.8	70.6
Duration of coaling ... hours	...	7	6¼	11¼
Temperature during the coaling ... ° C	...	180	200	230

PEAT INDUSTRY IN SWEDEN.

It is known that Sweden possesses great wealth in her peat bogs, which are only awaiting development. The peat production of the world amounts at present to from 9,000,000 to 10,000,000 tons a year. Russia comes first with about 4,000,000. Peat is used there for locomotives as well as in the factories. One of the largest cotton works in the world is located in Russia, and it uses peat exclusively as fuel. Most of the peat fuel of Sweden is used in the homes, but some is employed for industrial purposes. There are, for instance, in the province of Skåne, two factories using peat exclusively as fuel.

The quality of the Swedish peat is excellent, yielding an inconsiderable percentage of ashes. Moreover, the moors of Sweden are high and easy to drain. No other European country, excepting Russia, possesses such an abundance of good peat.

The next important question is the cost of manufacture. According to one calculation (in 1901) this is on an average 3 kronor (80 cents) per ton for unsheltered peat, to which must be added 1 krona (27 cents) per ton for transport and shelter. This would make the cost of the peat at the place of consumption 4 kronor ($1.07) per ton, which is equivalent to coal at 8 kronor ($2.14) per ton.

For machine-made briquettes, the rate (free on cart from the moor) was 5 to 6 kronor ($1.34 to $1.61) per ton.

Compared with the present prices for wood and coal, peat is unquestionably the cheapest fuel. One cord of pine wood must not cost more than 4 kronor ($1.07) if it would compete with peat at the above-mentioned rate. If 1 ton of hard coal is equal in fuel value to 1.8 tons of peat (the trial results vary between 1.6 and 1.8), the calcuculated peat price would be equal to a coal price of 10.80 kronor ($2.89) per ton—a price at which coal can not be bought in Sweden. The Government railroads, which are the largest consumers of coal in this country, and consequently are able to buy cheap, have during many years paid on an average 14 kronor ($3.75) per ton at the port of landing.

The Government and Parliament manifest comprehension of the great importance of the peat industry. The trials of firing with peat on the Swedish Government railroads have, according to the official report, shown that peat is about as expensive as English stone coal, when the rate is 9.50 kronor ($2.50) for the former and 16 kronor ($4.29) for the latter, exclusive of freight charges and the cost of loading on the tenders of the locomotives.

VICTOR E. NELSON, *Consul.*

BERGEN, *March 7, 1903.*

UNITED KINGDOM.

LIVERPOOL.

Only about 2,000 to 3,000 tons of briquettes are annually manufactured in this consular district. They are made by a firm in the town of Wigan, from bituminous-coal dust, and are used almost entirely for local domestic purposes. The retail selling price is about 20s. ($4.86) per ton. I have been unable to obtain the cost of production and the other particulars desired. Such information would not afford any criterion for comparison with what is done elsewhere, where the manufacture of such fuel is carried on upon a large scale, as in South Wales.[a]

JAMES BOYLE, *Consul.*

LIVERPOOL, *December 2, 1902.*

MANCHESTER.

After many inquiries, I have learned from the largest colliery proprietors in Lancashire that briquetted fuel is not manufactured in this consular district, the chief centers of production being Swansea and Cardiff.[a]

The few briquettes used in this district are made by the Whitfield Colliery Company, of Staffordshire. They are about the size of an ordinary brick and their chief component is coal dust (slack), with a little tar added. The price, delivered here, is 10s. ($2.43) for 300 briquettes.

WM. F. GRINNELL, *Consul.*

MANCHESTER, *December 17, 1902.*

NEWCASTLE-ON-TYNE.

Briquetted fuel is not now manufactured in this district nor in the districts of Carlisle and West Hartlepool. Some years ago, the pit heaps of waste coal in the north of England were utilized in conjunction with tar for this purpose, but, the supply of coal dust becoming exhausted, the industry was abandoned. Briquettes never were a success as a commercial commodity in this coal-mining district, coal being quite cheap here.

At Sunderland, the Wear Fuel Works Company, Limited, until recently made these blocks. The annual output was in number from

[a] A report describing the manufacture of briquettes in Wales was printed in Consular Reports No. 222, March, 1899. The methods in use are those employed on the Continent, full details of which are given in this series.

50,000 to 100,000. The materials used were bituminous coal dust and pitch, the latter for binding purposes.

The cost of manufacture depended entirely on price of raw material, which varied greatly from year to year. For example, bituminous coal dust runs from 5s. ($1.22) to 8s. 3d. ($2.01) per ton and pitch 19s. ($4.62) to 30s. ($7.30) per ton. At present, however, the latter is quoted at 55s. ($13.38), which is abnormally high. The cost of labor varied according to output.

The selling price of this fuel was generally equivalent to that received for best coal.

The briquette presses were mainly constructed by the company itself, and two kinds were used, viz, trough and table. Neither the machinery nor the process is patented.

The capacity of the plants was equivalent to about 50,000 briquettes per year of two hundred and fifty working days, of twelve hours each.

One of the briquettes that was manufactured by the above-mentioned company evaporated 14.4 pounds of water at 212° F., while the best North Country steam coal averages 14 pounds of water to 1 pound of coal.

PEAT FUEL.

There is a great future for peat as fuel. The most productive area for it is the north of Germany and the adjoining parts of Denmark and Holland. In Friesland, there are bogs hundeds of square miles in extent, and Germany has more fuel in peat than in coal. It is said that a square mile of bog 10 feet deep contains peat equal in heating power to over 300,000 tons of coal. Ireland has 1,000,000 acres of large bogs from 10 to 30 feet deep.

H. NIXON,
Vice and Deputy Consul.

NEWCASTLE-ON-TYNE, *December 6, 1902.*

NOTTINGHAM.

No briquetted fuel is made or sold in Nottingham. This city is in a coal-mining district and fuel is relatively cheap. Being informed that two colliery companies in other parts of this consular district were making briquettes, I wrote them on the subject. One of the companies has not replied. The other writes as follows:

> The cost of manufacture with us is now about 12s. ($2.92) per ton, pitch being very dear at the present time. Our average selling price is now about 12s. 3d. ($2.98) per ton.

FRANK W. MAHIN, *Consul.*

NOTTINGHAM, *December 23, 1902.*

EDINBURGH.

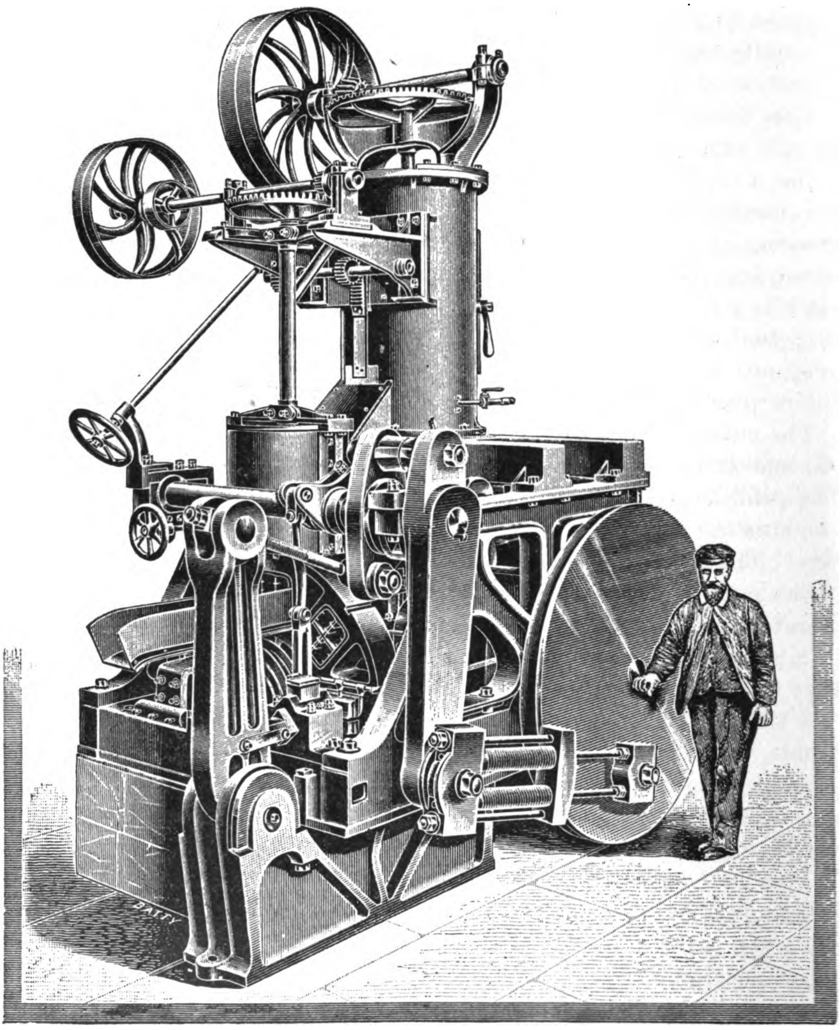
Briquetted fuel is produced at only one place in this district—the gas works recently completed by the Edinburgh and Leith corporations gas commissioners, at Granton, a suburb of Edinburgh. Mr. W. R. Herring, manager for the gas commissioners, in planning the new works, aimed to bring together all modern facilities and economies adapted to a gas-making plant, and in pursuit of this idea he added briquette machinery for the purpose of utilizing the coke siftings, a residuum of gas production heretofore wasted.

This briquette plant, with the necessary iron framework, etc., was erected at a total cost of $5,000, the price of the machine being $2,250. It has a capacity of 5 tons per hour. From the coke sifters of the gas works, the dust siftings are conveyed in small cars or wagons running on a light railroad to the briquette plant (about 100 yards away) and put into the hopper, and through another hopper common pitch is added as bonding material. To show the process of briquetting fuel at Granton, I give illustrations, the first representing the briquette machine proper and the second a longitudinal section of the entire plant (pp. 130 and 131).

The coke waste passes from the car or wagon (A) to the elevator (B) and is carried to F, whence it goes into the coke measurer (G). The pitch is put in the hopper (C) to the pitch cracker (D), and by the elevator (E) is conveyed to F, whence it goes to the pitch measurer (H). The materials pass to the mixer (S) in the required proportions (8 per cent of pitch is used at Granton), and from the mixer to the disintegrator (1), where they are pulverized; thence by the elevator (J) to K; thence to the vertical heater (L) of the briquette machine, where they are thoroughly fused by steam; thence to the pugmill (M). From this they are fed into the mold-plate in measured quantities. In the molds, the briquettes are pressed on both sides simultaneously, the pressure applied equaling about 2 tons per square inch. They are turned out of the mold-plate to the trucking belt (O) and pass to the car or wagon (P).

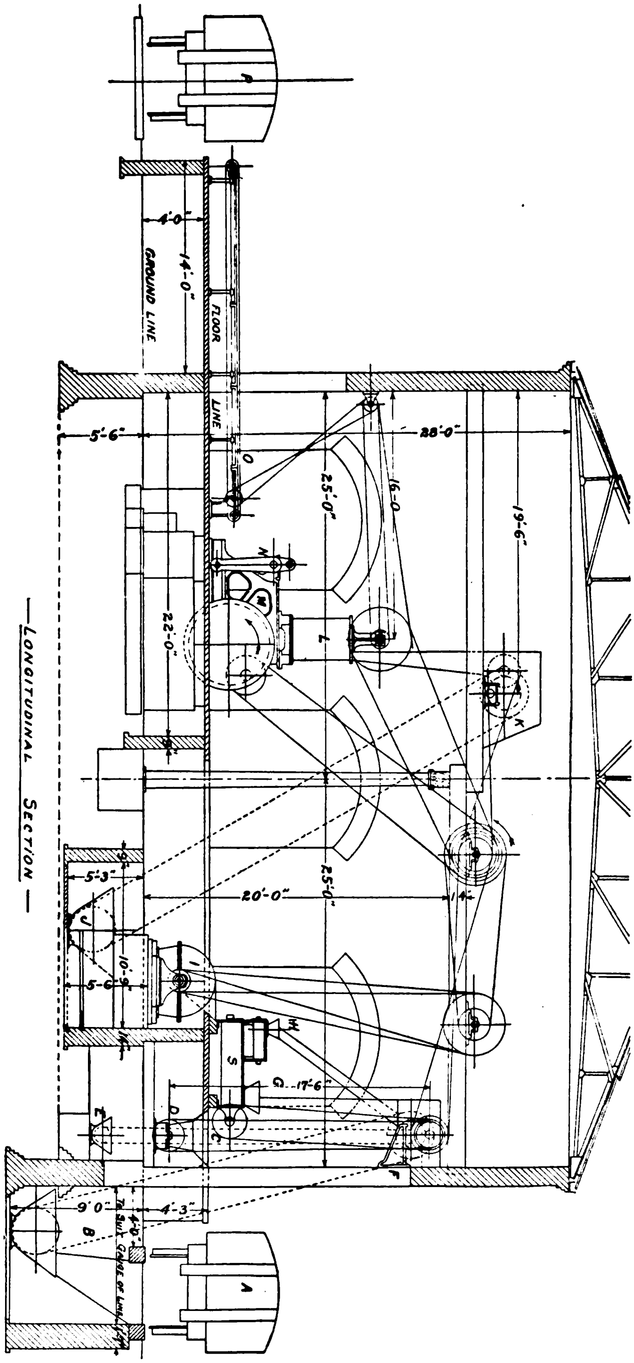
This briquette plant has been in operation for several weeks, with satisfactory results, barring a tendency to clog when the material is a little too wet. The labor cost of the product is approximately 35 cents per ton, the cost of pitch about 90 cents per ton, and interest on capital invested not more than 1½ cents per ton, making a total of $1.26½ per ton. The price of pitch is extremely high at the present time—$11.40 per ton; ordinarily it does not exceed $7. The cost of the power necessary to run the machinery is too small to be estimated, as the steam comes from the boilers of the gas works. The briquettes, which weigh 4 pounds each, are ready for immediate use as fuel, although it improves them somewhat to lie a week or ten days in the

open air. In Mr. Herring's opinion, a coke-dust briquette has considerably more heat value than the same weight of the best coal. It was his original intention to use the briquettes in the furnaces of the gas works, but he finds that it will be better economy to place this fuel on the market for household purposes at $2.50 per ton, which price will yield a good profit.



Johnson briquette machine.

I am informed that this is the first briquette plant to be erected in the United Kingdom in connection with gas works. It is the Johnson system (William Johnson & Sons, Leeds), patented, I believe, in the United States as well as in this country. The machinery is said to be adapted also for lignite, bituminous, and anthracite coal, charcoal, and


— LONGITUDINAL SECTION —
GROUND LINE
FLOOR LINE
4'-0"
14'-0"
5'-6"
28'-0"
25'-0"
16'-0
19'-6"
22'-0"
20'-0"
25'-0"
5'-3"
10'-9"
5'-6
17'-6"
9'-0"
4'-3"
4'-0"
TO SLY GAUGE OF LINE

peat, and for iron or other ores for smelting purposes. The sizes and weights of the briquettes produced can be modified as required to suit different markets or uses. The ordinary briquette plants of the Johnson pattern, as used for producing coal or coke briquettes, contain these items:

1. Chain elevators, fitted with steel links and buckets, chain pulleys and tightening gear, iron-bottom box, gearing and driving pulleys, for elevating small coal or coke into the mixer.

2. Pitch cracker, fitted with hopper, circular grate, steel breaking knives, frame and driving pulley, for breaking up the pitch; also set of small elevators for raising the broken pitch into the mixer.

3. Mixer or measurer, fitted with horizontal cylinders, adjustable blades, change wheels, and driving gear, for mixing coal or coke and pitch in the proper proportions.

4. Disintegrator, fitted with steel shafts, phosphor-bronze bushes, hardened-steel bars, wrought-iron disks, and iron covers, for pulverizing the coal or coke and pitch.

5. Chain elevators, for conveying the ground coal or coke and pitch into the vertical heater.

6. Superheater, for superheating steam, fitted with internal heating pipes and pyrometer.

7. Vertical heater, fitted with internal shaft, steel knives, inlet steam pipes and taps, regulating outlet, gearing and driving pulleys, and iron girder frame.

8. Briquette machine, fitted with feed, compressing, and rounding motions, producing briquettes uniform in thickness and weight, pressed on both sides simultaneously with a pressure of 2 tons per square inch by simple combination of lever and fly wheel.

9. Endless carrier, with standards, frames, rollers, endless belt, and driving motion, for conveying finished briquettes to the outside of the machine house.

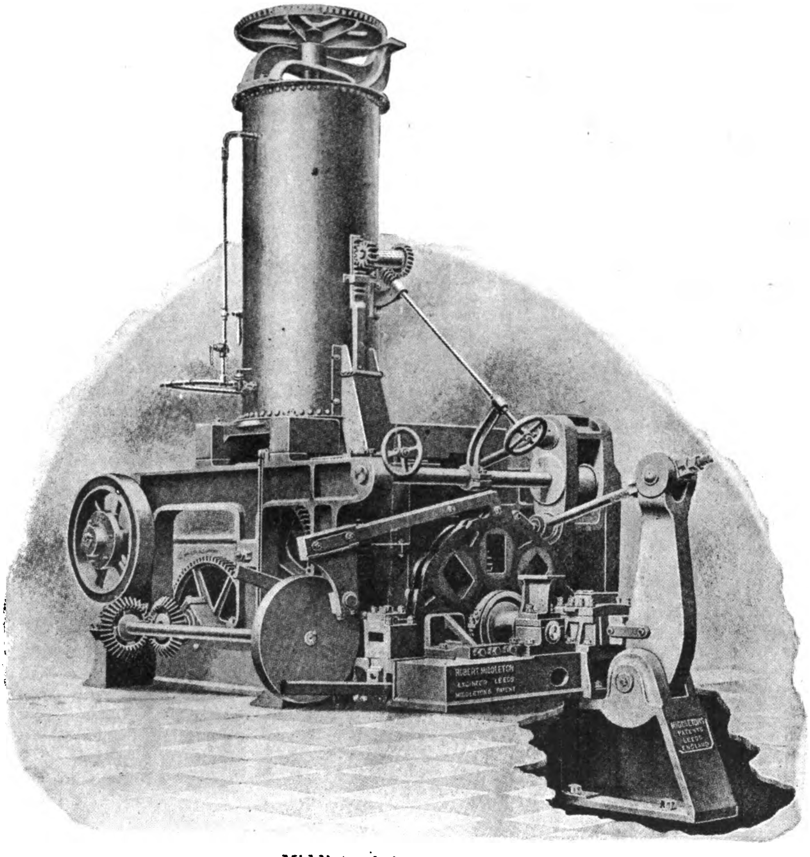
10. Shafting, including the main driving shaft, countershafts, driving pulleys, standards, couplings, pedestals, inside the machine house.

Plants are made in four sizes: No. 1, for producing 25 tons per ten hours; No. 2, for producing 50 tons per ten hours; No. 3, for 100 tons, and No. 4, for 200 tons.

Other patterns of briquette machinery in use in the United Kingdom, drawings of which I have examined, do not differ widely from the Johnson system in principle or operation. One of these patterns is the Middleton (Robert Middleton, Leeds), well known in the coal and briquette trade, especially in England and Wales. This machine also applies pressure to the briquettes on both sides simultaneously. I give an illustration of the machine, and also a print from a drawing of a longitudinal section of a Middleton plant producing 5 tons per hour (pp. 133 and 134). The price of the briquette machine alone is

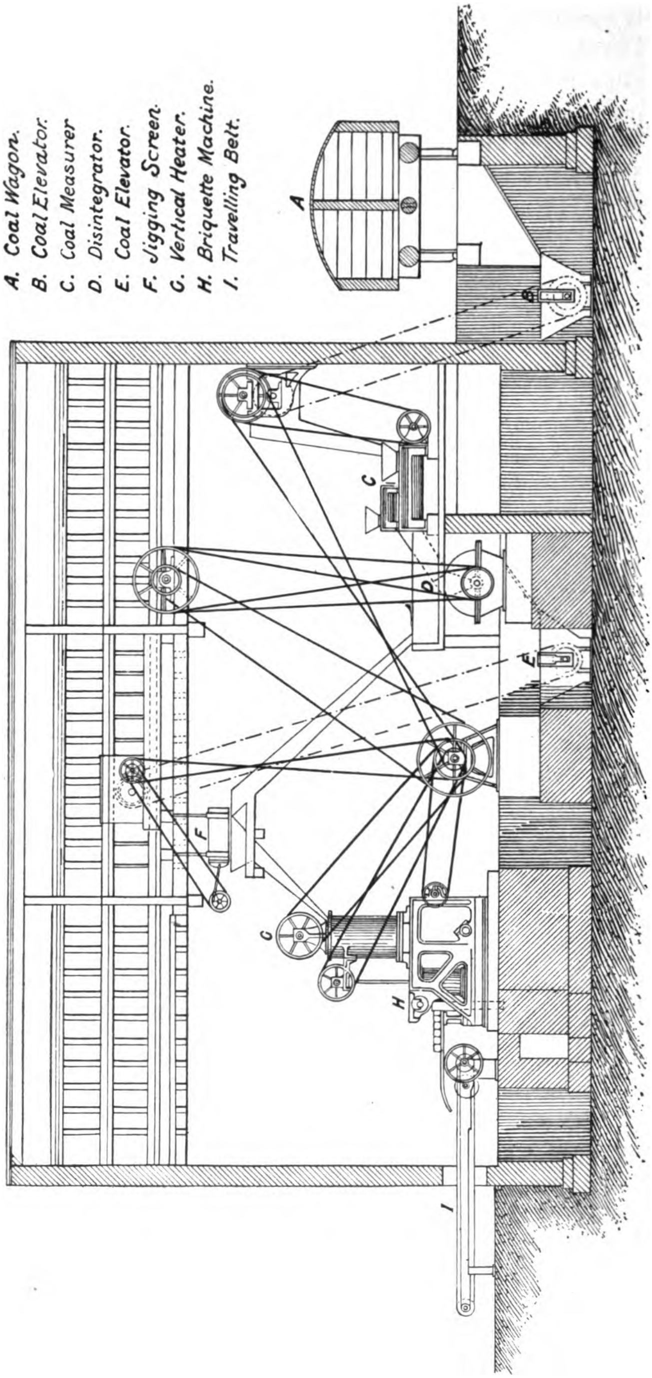
$3,300. Price of a briquette plant (exclusive of engines and boilers) completely installed, about $6,900. The Middleton machine is, I am informed, protected by patents in Great Britain and the United States.

Coal briquettes for household use were first made in 1877. For many years the industry has been chiefly carried on in Wales, where the coal screenings are better adapted for this use than is any other quality of coal produced in the United Kingdom. Ever since it was introduced, this fuel has been on the market in east Scotland. Dur-



Middleton briquette machine.

ing the past ten years, the consumption has gradually fallen off. Colliery owners in this district (where the coal is all bituminous) who installed briquette plants stopped the manufacture some years ago, as the local demand was not sufficient to warrant its continuance, especially in competition with the larger producers in west Scotland and north England. At the present time, the quantity of briquettes consumed is very small, in comparison with coal—almost inconsiderable. Practically, they are used only to keep fires overnight and in sick



Longitudinal section, briquette plant—Middleton system.

rooms where low fires are wanted in moderate weather. Unbroken, the ordinary briquette makes a slow and dull fire; if broken up, it is soon consumed. My inquires have not elicited a favorable opinion, either from coal and briquette dealers or from those who have used briquettes, as to this kind of fuel for general household consumption. It seems to be regarded as neither economical nor in other respects satisfactory, compared with bituminous coal. It was originally supposed that the use of a small quantity of this briquetted fuel in a grate with coal was economical—i. e., prevented the rapid consumption of the coal. In the opinion of householders whom I have questioned on the matter, this idea has been exploded. One gentleman who uses in his house a ton of coal every nine days related to me an experiment which he made with briquettes. He first bought 24 small blocks (5½ pounds each), costing 30 cents; these were used with a ton of coal, one briquette being put on a grate now and then to "slow down" the fire, and the ton lasted no longer than usual. He then doubled the number of briquettes, and the ton of coal was consumed in the same time as before. Then he used $1.20 worth of briquettes with a ton of coal, and the result showed no saving.

A special objection to coal briquettes with pitch as the bonding material is that they foul chimneys quickly. This is the testimony of chimney sweeps.

The retail prices of briquettes and coal in this city (delivered) are as follows: Briquettes, $5.52 per ton; 100 large blocks (11 pounds) or 200 small blocks (5½ pounds), $2.75; 12 large or 24 small blocks, 30 cents. English household coal, $6.95 per ton; Scotch household coal, $5.28. It thus appears that briquettes are higher in price than is Scotch coal, principally owing to the much longer railway haul.

Neither peat nor lignite is found in commercial quantity in this district.

RUFUS FLEMING, *Consul.*

EDINBURGH, *December 16, 1902.*

PEAT FUELS OF EUROPE.

The following article, contributed by Adolf Dal to the London Engineering Magazine for November, 1902, is sent by Consul Fleming, of Edinburg:

[While primarily of importance in countries where the cost of labor is low and the necessity for economy is acute, the use of peat is not without its industrial significance. It is reported that even in the eastern United States, resort has recently been had to peat fuel under pressure of famine prices for coal. The suggestion of its more extended use by the establishment of a power plant close to the source of supply, with power distribution thence by means of fuel gas or electricity, is particularly interesting and in direct line with the best modern practice in the economical utilization of natural resources.—THE EDITORS.]

Peat has long been used as fuel; in Germany especially, its use dates back so far that the ancient Roman naturalist, Pliny, tells us that that Teutonic tribe on the borders of the North Sea dried and burned "mud" (peat). Its more extensive use dates from the middle of the last century, when fuel for steam engines was required on a larger scale; and in very late years, high prices of coal have attracted renewed and most active attention to the use of peat fuel.

The bogs in which peat is contained cover extensive areas in the northern temperate latitudes, both in Europe and in America. In Germany, they cover nearly 30,000 square kilometers (11,583 square miles), and in Ireland, according to Lyell, they cover the tenth part of the country. The depth is very variable, but is on an average 5 to 7 meters (5.4 to 7.6 yards) and more; thus in Ireland, bogs are found with a depth as great even as 15 meters (16.3 yards). It may be estimated that 1 square kilometer (0.3861 square mile) of 5 meters (5.4 yards) depth will give about 700,000 metric tons of dried peat; hence it will be seen that the amount of fuel in these bogs is enormous.

Peat is all organic matter, formed from mosses and other minor plants which have been submerged in water and thus preserved in the bogs. As it exists in the bogs the largest constituent is water, dry matter forming only about 10 per cent of the total weight. When peat from the bogs is used for fuel, therefore, much water must be removed, and this forms a great difficulty in the manufacturing. In fact, the drying of the peat is everywhere regarded as the most troublesome point, for it is impossible to remove the water economically in any artificial way, either by pressure or by heating in kilns or kiln-like appliances; the peat must be dried in the open air, and the preparation thus becomes much dependent on the climate. In level, open countries, however, where the wind is constantly blowing, the drying in ordinary years will be very well performed. In almost all districts, the peat is spread out to dry in the open on the leveled and evened surface of the bog; only in certain very rainy countries, as in southern Bavaria, Styria, and in western Norway, shelters are sometimes used. Peat dried in the air will hold about 20 per cent of water.

The most ancient method of digging peat, still much used, is the simple one of cutting it by hand with a spade in regular, rectangular pieces, which are then spread on the leveled surface of the bog and dried. At present this method is much used in the Netherlands and in Germany. Although it requires much labor, yet it will often give a very cheap fuel, especially where wages are low, a skilled laborer being able to work 1 metric ton of dried peat in a day. Probably the larger part of the peat produced in the countries just named is such "cut peat." But as wages grow higher, this method will tend to fall into disuse.

Cut peat, however, is of somewhat loose consistence and has an excessively large bulk, a hectoliter of it weighing on an average 20 kilograms (12 pounds to the cubic foot). As it takes 2 pounds of peat to equal 1 pound of ordinary coals, it will be seen that 8 cubic feet of cut peat must be used to equal 1 cubic foot of coals. Hence it follows that transportation will be costly, and storehouses and fire rooms must be very large where this peat is used.

In order to reduce the volume, peat-milling machines have been commonly introduced into all European countries within the last fifty years. In these machines the fibrous structure of the peat is broken up, the mass kneaded, mixed, and somewhat pressed together; it contracts considerably in drying, the volume of the dried peat often being only one-eighth of the original. Thus the peat gains a very compact consistence, and bears a close resemblance to lignite, both in appearance and density. The specific gravity often surpasses that of water; most commonly, its weight is about 40 kilogrammes per hectoliter (30 to 40 pounds to the cubic foot). In this form the peat may be transported, its weight giving a full wagon load. Nor is the machine-made peat so hygroscopic as the cut peat; it may be easily stored without absorbing water. When dried in the air, it contains 15 to 25 per cent of water.

Most of these machines knead the peat as it is taken from the bog. The machines thus used consist of a hollow cast-iron cylinder or cone, in which rotate one or two rollers set with knives or screw ridges, which break up the peat, mix it, and, lastly, press it through a mouthpiece, which it leaves in the form of a continuous rectangular block. This block is wet and soft as the peat in its natural state, and is cut in pieces at proper lengths and then carried off to dry. Peat made in this manner is often called on the Continent "compressed peat" (in German, "presstorf"), but it is evident that the pressure has been very slight; no water has been pressed from it, and its chemical composition has not changed; the only change is the increased density.

The first of these machines were constructed in 1861, by C. Schlickeysn, in Berlin, and though since then modified in various respects, they are still, on the whole, much like the original model. The most modern and most improved are those from the Munktells factory, at Eskilstuna, in Sweden, constructed by the Swedish engineer Aleph Anrys (p. 138). Several hundred of these machines are in use in Sweden, and especially in Russia. On the large bogs of the latter country, often up to 20,000 acres in extent, 50 to 70 machines of this kind may be seen at work. Each machine is worked by a locomobile of 12 horsepower, and employs 30 laborers, the daily output being 40 to 60 metric tons of peat in the dry state. The working costs are about 3s. 4d. (80 cents) per metric ton of dried peat, the wages of the laborers being about $1 (in Sweden).

In Germany, most of the peat-pressing machines are made by R. Dolberg, in Rostock, and by A. Heinen, in Oldenburg (p. 141). All these machines are much alike in their construction. The peat is dug from the bog with the spade and filled into an elevator, which carries it into the milling machine. Much hand work and many laborers are thus required for these machines, but they are able to handle 1½ to 2 tons of peat per man per day.

Improvements may be made in these European peat factories, especially by replacing the individual locomobiles at each machine by a central power plant and transmitting power to an electric motor for each peat presser. The digging and carrying away of the peat, which is everywhere performed by laborers, ought also to be done by electric power. Costs would then be much reduced where wages are high.

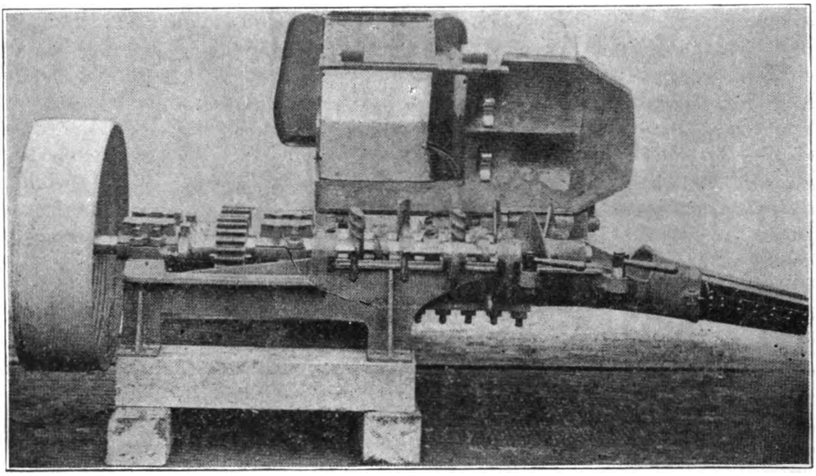
Digging and cutting machines, both for hand and steam working, are used in eastern Germany and in the Netherlands, but only where the bogs are so wet and swampy that the water may not be drained away and cutting by hand in ordinary manner is consequently impossible. Most of these cutting machines are made by Dolberg, in Rostock. They are used floating on prams or standing on rails on the bogs. The peat dug out is then immediately carried to the milling machines, but may also be used as ordinary cut peat. In the Netherlands, one single manufacturer by this method makes in a summer nearly 100,000 metric tons of dried peat, all of which is sold in Amsterdam, the selling price being about 18s. ($4.30) per ton. The Dutch burn peat in place of coal in their stoves, hence the high prices.

In some places, the peat is milled together with water, and the half-liquid mixture is then molded in, forms like bricks. This method is used in the Netherlands and to some extent in Sweden, but has been worked out more particularly in Denmark. In that country, one of the best-planned peat factories in Europe is to be seen at the little railway station Sparkjer, in Jutland. The operations performed there are rather different from those of other places and will prove advantageous everywhere they may be used. The milling machinery is not, as in other peat factories, placed on the bog itself, but on the flat and sandy land immediately at the shore; the peat is carried up to the mill by a locomotive. The mill is driven by a stationary 12-horsepower steam engine and is of very simple construction, consisting only of a rectangular box 13 meters (14.1 yards) in length, in which rotates a roller set with knives that will break up the peat and mix it with water. The roller makes about

60 revolutions per minute. In this manner the peat is got into a semiliquid state; it is then carried on rails by horses to the drying plain, where it is molded into forms. The drying plain is situated on the flat and sandy land surrounding the bog; the same drying plain is thus used three or four times during the summer season.

Sixty-five metric tons per day of dried peat are thus made by 20 laborers, giving an output of more than 3 tons for each man. The costs of production amount to less than 2s. 6d. (60 cents) per metric ton, the wages being about 5s. 6d. ($1.33) a day. In the figures of costs of the peat given here and elsewhere, amortisations are not included, but as these are rather small they will not tend to increase costs substantially. The whole installation at Sparkjer, with exception of the bog, cost about $9,000; as the peat is sold on the place at a price of 7s ($1.75) per ton, it is seen that there will be a good margin of profit.

In the peat factory at Sparkjer, some floating peat mills are also used. The milling machinery, together with a 2-horsepower gasoline motor, is mounted on a pram floating in the turf pit. At these small plants 4 laborers will make 13 tons of dried peat per day. Costs are even smaller than the above, not exceeding 51 cents per



Anrys' peat milling machine, opened to show construction.

metric ton. Throughout Europe, machine-made peat is nowhere produced at so small cost. The inventor of the appliances at Sparkjer is the Danish captain of horse Rahbek.

For a long time, much attention has been given to the coking of peat in order to get a substitute for wood charcoal and for coke, the charcoal of peat ranging between these two. Formerly, peat coke was used in several places in Germany and in Austria for metallurgical purposes, and many different methods and various kilns have been proposed and used for the coking, all of which have proved more or less unsuitable for the purpose, uneconomical, and upon the whole unsuccessful, the peat coke being too costly to compete with coke from coal. In Europe, therefore, there was for many years only one factory for peat coking, but in the last two years one or two more have been established. A plant with five kilns, according to the method of Dr. Ziegler, of Berlin, was erected in 1894 in Oldenburg, in the midst of the most extensive peat areas of Germany. In each kiln, 10 to 12 metric tons of peat are coked in twenty-four hours, 3 tons of peat giving on an average 1 ton of coke. The heat in the kilns reaches 600° C. (about 1,100° F.) and the coking is complete. All volatile matter is driven out and the coke burns without flame. The gases are used for the

heating of the kilns, and are sufficient for that purpose and for heating in addition the boiler of a steam plant. The coke is sold at a price of 60 marks (60 shillings, or $14 to $15) per metric ton, but as it is almost completely free from sulphur, it is highly useful for metallurgical purposes and thus competes with wood charcoal. It is also much used by braziers and the like. Besides coke and the heating gases, the peat on coking will give tar and tar water, this being actually the case in Oldenburg, where gas, oil, sulphate of ammonium, etc., are sold as secondary products.

Dr. Ziegler has planned in Russia a coking plant for peat on the same principles as that in Oldenburg, but with the object of getting coke for locomotive use. The locomotives in Russia usually are fired with wood and mineral oils, as coal is scarce in that country and the importation is very small. In order to be independent of foreign supply of fuel, the Russian Government is trying to use peat coke for firing the locomotives, and has built a plant on the Ziegler system at Redkino, on the railway between St. Petersburg and Moscow. In view of the purpose for which the coke is intended, the coking is not complete, but the fuel retains much of the bituminous matter and therefore burns with a long and bright flame. The yield of coke from the peat is thus increased, so that the weight obtained is half that of the peat. The success of this plant has proved good, and it is the intention to build several others in various places in Russia.

In western Norway, near Bergen, a peat-coking plant has been built of late on somewhat different principles, the heating being effected by an electric current taken from a waterfall in the neighborhood. Each kiln is loaded with 400 to 500 kilograms (882 to 1,102 pounds) of dried machine-made peat, and the coking takes some three to four hours. The electric current is of 500 amperes with a tension of 40 to 50 volts; the temperature in the kilns is about 300° C. (570° F.). The coke is rather compact and burns with a long and bright flame; it is very well suited for domestic purposes, and sells in Bergen at a price of 15s. ($3.60) per metric ton.

In very recent years, factories have been built in Europe for the briquetting of dried peat; the briquettes are much like those of brown coal (lignite) in appearance and calorific power; they are very solid, and have a fine and polished surface from the strong pressure. The peat is partly dried artificially in the factory, then crumbled, and lastly pressed in open press forms under a very heavy pressure—about 1,500 atmospheres. The press forms are open, as the friction is sufficient to produce the needed resistance. The specific gravity of the peat briquettes exceeds unity, and they have a calorific power about three-fourths that of ordinary coal. At present there are four such plants existing in Europe, viz, two in Germany, one in the Netherlands, and one in Russia, but it is to be supposed that more will be built, as the briquettes of peat, as well as those of lignite, are very clean to handle and thus very well fitted for household use as fuel.

Germany and the Netherlands are the native countries of peat-fuel making. In both these lands peat has been used from very ancient times, as already stated, and it is in Germany that most of the modern methods for its manufacture have been worked out. In fact, especially in Germany, much labor and much money have been spent in various unsuccessful methods of manufacture. In these countries also peat is to-day very commonly used, more especially in the Netherlands. Within recent times Sweden, Denmark, and Russia have widely enlarged their peat production. In Austria, also, peat is much used in factories, especially in glass houses and brick manufactories. In Norway peat is used in the stoves in the western part of the country, where wood is scarce; but though bogs are found almost everywhere, there are no large peat factories, owing to the scanty population of this country, and to the fact that water power is obtainable in most places for industrial uses.

Apart from hand cutting of peat, milling through machines as described is almost the only method used throughout Europe. But as the peat to fill into the machines is dug by hand, many laborers are required, and this circumstance will make peat

costly where wages are high, and as these tend to increase everywhere, machinery must be constructed to dig the peat; but with the exception of very low-lying bogs where water stands on the very surface, such appliances are nowhere used as yet.

In northwestern Germany and in the Netherlands, peat is used chiefly as domestic fuel and, as stated above, is sold in Amsterdam at prices absolutely higher than those of coal, peat measured by its thermal effects being more than twice as costly as coal. There is no special construction of the stoves, but in Denmark a special patented device, the so-called "spit stove" of Mr. Reck, is used for peat combustion.

In southern and eastern Germany, but above all in Russia and in Sweden, peat is used principally for industrial purposes, a great many boilers, small and large, being peat-fired. In breweries, distilleries, and under salt pans, peat is used in Germany on a very large scale and is very advantageous for these purposes, the heat being not so intense as when coal is used. Moreover, as peat contains no sulphur, the caldrons and boilers are not subject to so much injury as when coal-fired. It is estimated that they will last three times as long as when coal is used for fuel. Boilers of any size may be heated by peat; for the larger units, step grates are the most suitable; the peat may then be fired even when rather wet, this being of importance in summers when drying is difficult and not thoroughly performed.

Ordinary peat has a thermal effect about half that of coal, the accurate proportion being as 1:1.8. Hence it follows that the transportation of a thermal unit in peat will cost about twice as much as in coal. Establishments based upon the use of peat fuel should therefore generally be placed very near the bogs, this being actually the case in eastern Germany and in Russia. But as this is a very heavy drawback, bogs often lying apart and far from the great lines of transportation, central power plants should be erected in the middle of the large bog areas and power transmitted electrically to places more suitable for the factories. Such power plants have not as yet been established, but it is easy to show that fuel for one horsepower in such a plant, erected in the immediate vicinity of the bog, will cost only one-ninth of a cent per hour.

In an article contributed by W. O. Webber to this magazine for the issue of September, 1898, it is stated that in the best large steam-power plants, only 1 pound of coal is used for one horsepower hour. As 1 pound of ordinary coal is equal to 1.8 pounds of peat, this costing 5 s., or $1.25, per ton, the cost of peat fuel will not exceed one-ninth of a cent per horsepower hour.

Gas from peat is used for heating purposes in several places in Europe, but most extensively in Sweden. In that country it is used for the melting of Martin steel, while in other places it is used in glass houses and the like. The generators used are of very simple construction. In a Swedish magazine, Jernkontorets Annaler, Rich Aakermann has given an exhaustive memoir on the use of gas for Martin steel melting.

The peat used in Sweden for generating gas has the following composition:

	Per cent.
Carbon	60
Hydrogen	6.4
Oxygen	31.7
Nitrogen	1.9

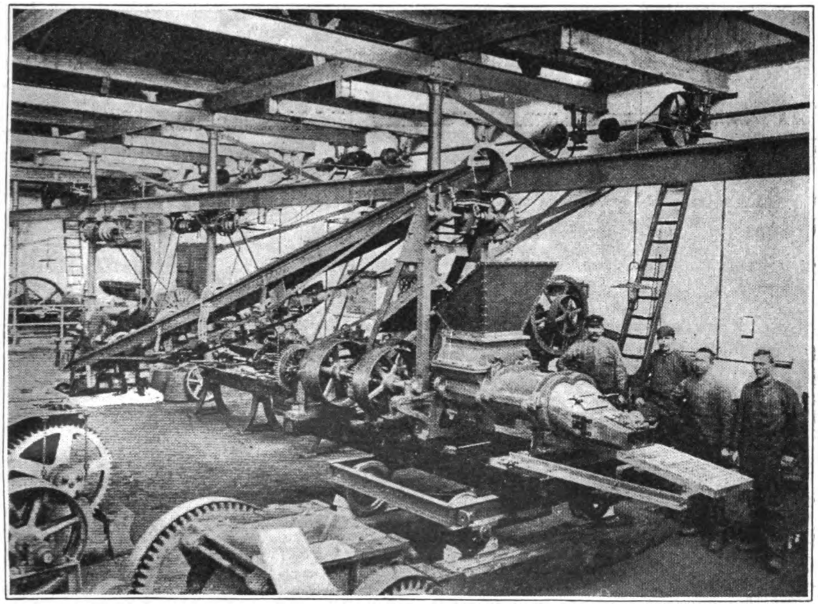
Or, if hygroscopic water and ashes be reckoned:

	Per cent.
Carbon	38.2
Hydrogen	4.1
Oxygen	20.2
Nitrogen	1.2
Sulphur	0
Ash	8.6
Water (hygroscopic)	27.7

The gases have the following composition:

	Per cent of volume.
CO_2	6.9
CO	26
C_2H_4	.5
CH_4	4.4
H	8.5
N	53.7

The quantity of gas obtained from 100 kilograms (220.4 pounds) of peat is about 252 cubic meters (8,900 cubic feet). The sorts of peat here used have an excessive amount of ash and much hygroscopic water. In fact, ordinary peat will not have more than 5 per cent of ash, and when well dried in the air it will not contain more than 20 per cent of water; under such conditions, the gas will be of much better composition.



Heinen's works for building peat milling machines at Varel, Oldenburg, Germany.

It is not known that peat is used anywhere in Europe to produce power gas on any particularly large scale, but the results obtained of late with the Mond gas generators, where power gas is generated from slack coal with 60 per cent of carbon, would tend to show that peat will give as good results.

In reality, there is no great difference between such slack coal with 60 per cent of carbon and good peat, the only difference being the greater contents of water in the peat. But as 2½ tons of water, as steam, are used in the Mond gas generators to 1 ton of slack coal, to regulate the process, the larger amount of water in the peat must not be considered as a drawback, but rather as tending to make the generating of steam superfluous and thus to reduce costs.

In the figures given above, showing the composition of Swedish peat gases, nitrogen is present in rather large amount. This results from unmixed air being used for the combustion in the generators; when it is properly mixed with steam and carbonic oxide, the results obtained will prove better.

It is now well known that gas may be led economically to great distances for power supply and for incandescent lamps. Thus, Mond gas is piped in England from central gas works to the surrounding factories, and in Pennsylvania natural gas is piped for distances exceeding 90 miles. There is no reason why gas from peat should not be used in the same manner.

It is my opinion that where the peat can not be used in factories on the spot, it should not be transported, as costs will be nearly double those for carriage of coal; but power should be transmitted, either in the form of electricity or as peat gas, the former for long distances, the latter for shorter ones.

The use of peat on a larger scale than hitherto will not only prove to give cheap fuel, but the digging out of the bogs will in many cases make the countries more wholesome, and the bottom of the bogs will give a fertile soil, as is seen in the Netherlands.

DUNDEE.

The manufacture of briquetted coal, peat, or lignite, so far as this district is concerned, does not exist. Coal briquettes are consumed, but the quantity used is so small that it is almost inappreciable as an article of commerce. They are retailed at from 16 cents to 24 cents a dozen, according to size.

As this district receives a full and cheap supply of coal from the large mines of the adjoining county of Fife, it would seem that there is no opening for peat and lignite briquetted fuel. Deposits of both peat and lignite no doubt exist in the Highlands, but not to any considerable extent.

JOHN C. HIGGINS, *Consul.*

DUNDEE, *November 9, 1902.*

DUNFERMLINE.

Owing to the cheapness of coal, which is one of the principal industries of this section, the sale of briquettes—tried several years ago in some parts of the district—did not prove a success, and fuel of that description is not now in use here. The only attempt to manufacture briquetted fuel in the consular district was by the Alloa Coal Company at Alloa, which was discontinued, I am informed, owing to the fact that it could not be manufactured and sold at a profit in competition with coal.

Briquetted fuel is manufactured to some extent in the west of Scotland, but the chief centers of the industry are Wales[a] and Northumberland.

Briquette fires last for a long time without requiring attention, but when poked the briquettes crumble to pieces, and they are therefore not suitable for boiler furnaces.

J. N. McCUNN, *Consul.*

DUNFERMLINE, *March 10, 1903.*

[a] See footnote, p. 127.

GLASGOW.

It is estimated that about 60,000 tons of briquetted fuel are manufactured and used annually in Scotland. Practically the whole of this amount is produced and consumed in this consular district.

The briquettes are made from waste bituminous coal, which in most cases is washed before being used, and their composition is, roughly, 90 per cent coal and 10 per cent pitch.

The cost of manufacture per ton is as follows:

Pitch, at, say, $12.16 per ton	$1.21
Washed small coal, at, say, $1.21 per ton	1.09
Wages, interest, and money invested in wear and tear of plant, per ton	.24
Total	2.54

The average selling price at works is $2.92 per ton.

As to the method of manufacture, the small coal is first ground to about the fineness of sawdust; then the pitch is mixed with it. The mass is then dried and solidified and cut into blocks, usually four pounds in weight and oblong in shape. Plants that have given most satisfaction in Scotland are made by Messrs. Yeadon & Co., Leeds, England.

The average daily capacity of one of these plants is about 100 tons, and to operate it three or four men and as many boys are required. The boys are employed in removing and stacking the blocks.

The briquette plants in Scotland are located at the works of—

Messrs. William Baird & Co., Limited, Cumnock, Ayrshire.
Messrs. The Coltness Iron Company, Limited, Newmains.
Messrs. James Nimmo & Co., Longrigg Colliery, Slamannan.

Almost all the machines used in the manufacture of briquetted fuel have been patented, but in most cases the patents have practically expired.

The heating power of briquettes is about the same as that of bituminous coal.

SAMUEL M. TAYLOR, *Consul.*

GLASGOW, *December 2, 1902.*

CANADA.

PEAT-FUEL INDUSTRY IN CANADA.[a]

Recognizing that a good and cheap substitute for anthracite coal would prove a great boon to the people of many States of the Union, and having learned that the efforts in Canada to produce dense fuel blocks from peat have within the last few months been brought to a

[a] Reprinted from Advance Sheets No. 1491, November 10, 1902.

successful issue, I have made inquiry with a view to reporting whatever has been definitely accomplished, and I find that practical experiments, which have been perseveringly continued for some years, have now resulted in the economical production of a salable peat fuel, highly satisfactory for domestic purposes.

Manufacturing operations on a commercial scale have been reported upon by engineers of high standing, and all agree in the opinion that methods and appliances are now available whereby peat briquettes may be produced, ready for shipment, for a maximum manufacturing cost or $1.50 per ton, and probably for considerably less in plants of large capacity.

There is some difference of opinion as to the length of time a given weight of peat briquettes will burn, as compared with the same weight of anthracite. Theoretically, the heat units in peat being fewer, it may be argued it must burn out faster; but with effective control of drafts, it is surprising how nearly its lasting quality approaches that of hard coal, as more perfect combustion is usually had in the burning of peat under ordinary conditions.

Preeminently to two individuals (Joseph M. Shuttleworth, of Brantford, Ontario, and Alexander Dobson, of Beaverton, Ontario), in association with the Peat Machinery Supply Company, Limited, of Toronto, and the Peat Development Syndicate, Limited, of Brantford, is due the success of this new industry. The machinery in operation at Beaverton is reported by the secretary of the Ontario bureau of mines as "withstanding the test of steady usage, producing sufficient fuel for the town, with some over for shipment."

A word of caution to intending operators may be timely. I notice many references in the public press in regard to the formation of companies proposing to utilize peat beds. Fully $400,000 has in the course of seven or eight years been practically wasted in Canada in futile attempts in this line. It would appear advisable for intending operators to confer with those in Canada, who have the advantage of thorough acquaintance with peat in its practical manipulation, before adopting untried methods or appliances. European practice, I am told, although successful, in many instances environed by special circumstances, notably cheap manual labor, can not be profitably followed on this side of the Atlantic.

Many peat deposits are not suited for practical use. Only bogs of an average depth of 4 feet and upward and of considerable area (at least 100 acres) should be selected, on account of the expense of the plant. The quality of the peat, feasibility of drainage, and accessibility to some means of transportation should also be considered. Mr. E. J. Checkley, of Toronto, who has been intimately connected for years with peat development in Canada, is investigating peat properties in Illinois, Wisconsin, and Minnesota. He reports that the grass peats

of Wisconsin appear to carry so great an admixture of alluvial substances as to make the percentage of ash too high to admit of the satisfactory use of the peat for commercial purposes. The moss peats of northern Wisconsin are much superior in quality, although farther removed from large centers affording the best markets.

The Canadian industry has profited by the cooperation existing among the organizations and individuals I have mentioned as interested in peat development, obviating one source of weakness arising out of attempts made by individual patentees, whose achievements usually embrace only one appliance, leaving many important steps wholly unprovided for. Every one of the many links required to complete the chain of apparatus for a complete outfit should be made sure of before investors embark in the enterprise.

EDWIN N. GUNSAULUS, *Consul.*

TORONTO, *October 31, 1902.*

SUPPLEMENTARY.

Since the publication of my report of October last, I have received scores of letters from persons who desired more detailed information as to the methods employed in the manufacture of peat fuel, the kind of machinery in use, etc., showing an unusual degree of interest in the subject.

Soon after making the report mentioned, I visited the plant at Beaverton to see the methods employed in the manufacture of peat fuel. The season was so far advanced when I made my visit (in November) that the field work had been suspended by reason of frost, and I was therefore unable to see this part of the process in active operation. The plant was, however, at work on peat which had been harvested earlier in the season and stacked for winter use. I was informed by Mr. Dobson, the owner of the plant and the inventor of the appliances in use, that all that is necessary for the continuous operation of the plant the year around is to harvest semidry, and stack during the summer, a sufficient supply of peat for the months when harvesting is impossible.

During the past summer, this plant was the center of a great deal of interest to people from many parts of the United States and Canada; and with a view to ascertaining the cost of manufacturing peat fuel, several mechanical experts have been sent, by prospective investors, to make thorough tests of the whole process and of each of the several appliances.

Mr. Dobson informed me that owing to the excessively wet summer, and because of extensive experiments, which were only completed in August, the amount of peat harvested was not sufficient to

run the plant through the winter, or it would have been operated continuously. Hereafter, it is intended to keep, if possible, a year's supply ahead.

In my report of October 31, 1902, I cautioned intending operators against adopting untried methods and appliances, and now for their benefit I give the following information gleaned from a report by Mr. James Milne (an engineer of Toronto) which was made for the benefit of interested capitalists.

A suitable bed of good quality of peat, of sufficient area to warrant the erection of a plant and capable of being drained, having been secured, the several operations are the following:

1. Ditching and cleaning the surface of that portion of the bed to be used for digging and drying operations.

2. Track laying.

3. Digging, pulverizing, and spreading the peat over the surface of the bed, where the moisture is rapidly given up in ordinarily dry weather. This is most important. A great amount of money has been expended in trying to prepare peat for the drying plant, but hitherto without much success, as the handling of 80 or 85 per cent of water contained in peat beds is naturally a very serious problem.

At the Beaverton plant this is done by an excavator, or harvester,[a] which digs, pulverizes, and spreads the peat at one operation, only one man and a 10 to 15 horsepower motor being required to handle from 100 to 150 tons in ten hours, when engaged in working on peat containing about 80 per cent of moisture.

The harvester consists of an endless chain with special buckets and cutters, driven by suitable mechanism, which cuts the peat the entire depth of the bog, and elevates it to a conveyer about 8 feet above the bottom of the bog. The machine is so arranged at present that it can cut any depth down to 4 feet, the depth being easily controlled by the raising or lowering of the lower end of the case containing the endless chain with the cutters and buckets. The spreading of the peat on the dry top of the bog is a most important part of the work, as tests show that the moisture can be reduced to about 36½ per cent after several hours' exposure on a good drying day. The whole machine, the harvester and spreader combined, is driven by a 6-horsepower electric motor. The rate of travel is from 3 feet to 3 feet 6 inches per minute, and the width of the cut is 12 inches.

When the frost is out of the ground in the spring the men set to work to dig enough crude peat for firing the drier and boiler during the entire season. One man can dig sufficient peat in one day to keep the drier and boiler going two days. One man is also engaged in wheeling this crude peat to the boiler and drier.

4. Gathering the peat after it has been exposed to the action of the sun and air, 70 tons of water out of each 100 tons of material having

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[a] See page 148.

been evaporated by this drying process. The gathering was done by two men at the time Mr. Milne made his report, but I am informed that now, by means of an electrical peat gatherer, propelled by a 5-horsepower motor, the work of several men is accomplished by one, thus effecting a considerable saving in the cost of finished fuel.

5. Loading on electric dumping car and bringing the peat to the works or stack for winter use. This stage completes the field work. A car, driven by a 5-horsepower electric motor, is run from the level of the bog to a height of about 12 feet, where it is dumped into a large bin. The fuel is conveyed from this bin into the breaker, preparatory to its entering the drier. One man and a 5-horsepower motor can handle sufficient material in ten hours to make 30 tons of fuel. From this stage the process of manufacturing is automatic.

The first five stages are estimated to cost at the rate of 40 cents per ton of finished product.

6. Mechanical drying. The peat is conveyed from the bin or from the stack to the breaker or pulverizer, where it is further disintegrated to facilitate drying, and thence passed to the drier, which consists of two steel tubes 35 feet long, inclosed in a brick arch, these tubes being provided with special devices for causing the rapid evaporation of the moisture remaining in the peat. The drier is fired with crude peat.

From the drier, the peat can be sent directly to the press or be stored in the bin. The last is so constructed that it is possible to arrange the different outlets leading to the press conveyer so that peat containing different percentages of moisture can be mixed on the way to the press.

7. Compressing into hard, dense blocks of finished fuel. As the press[a] is a most important appliance in the manufacture of the fuel (the lack of a suitable one having, I am informed, retarded the enterprise for years), I will quote from Mr. Milne's report:

> The machine runs very nicely indeed. There is no jar, and unless you are intently listening you are unable to tell whether the press is running empty or doing work. Before I saw the machine I had to some extent made up my mind that there might be some point in connection with the revolving die block that might cause serious trouble, but after watching it work several hours at a time, with no one paying any especial attention to it, I am convinced that it can do most efficient work. Not once did I see it miss a block, and all the blocks were the full size and ran about the same weight. There are no water jackets around the dies, and the wear and tear upon them must be small. There are eight dies on each block, and I examined those that had been in operation for some time and the tool marks were still there. The diagram taken at the engine showed that only 13.77 horsepower is required to run the press up to this capacity of 2,651 pounds per hour, including all conveyors in connection with the same.
>
> The daily capacity of the press is 13¼ tons, say 12½ tons, and the total cost of manufacturing less than 90 cents per ton on an output of 12½ tons per day of ten hours. The above includes absolutely all the labor, including superintendence of the plant, but does not include repairs, depreciation and royalty, nor does it include interest on investment.

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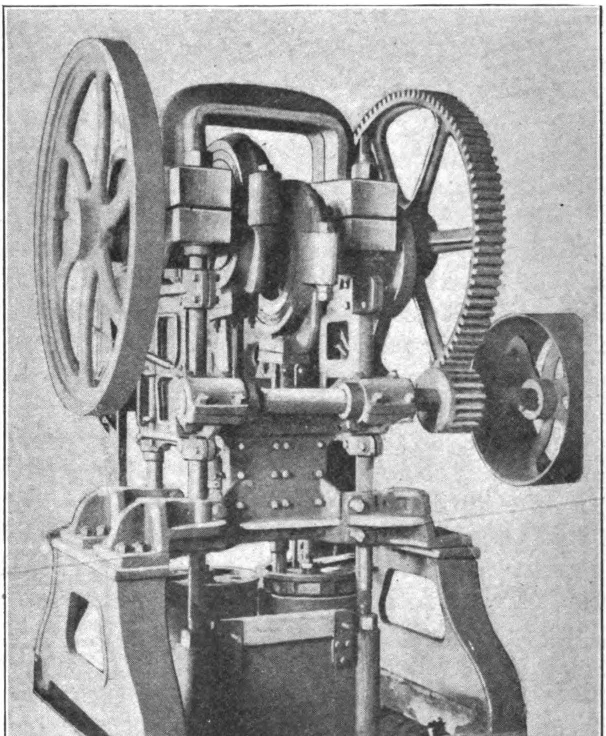
[a] Page 149.

Mr. James Lang, another well-known mechanical engineer, who was sent by capitalists of Toronto to report upon the manufacture of peat fuel, says:

During the summer of this year (1902) I had occasion to visit the peat factories at Beaverton and Welland, for the purpose of investigating the process and reporting on the cost of manufacturing peat fuel. I entered upon the investigation with grave misgivings as to the practicability of manufacturing upon a paying basis, but the successful working of the Beaverton plant was a revelation to me. The new machinery designed and introduced by Mr. Dobson, of that town, has revolutionized the process and made it possible to place peat fuel upon the Canadian market at a price



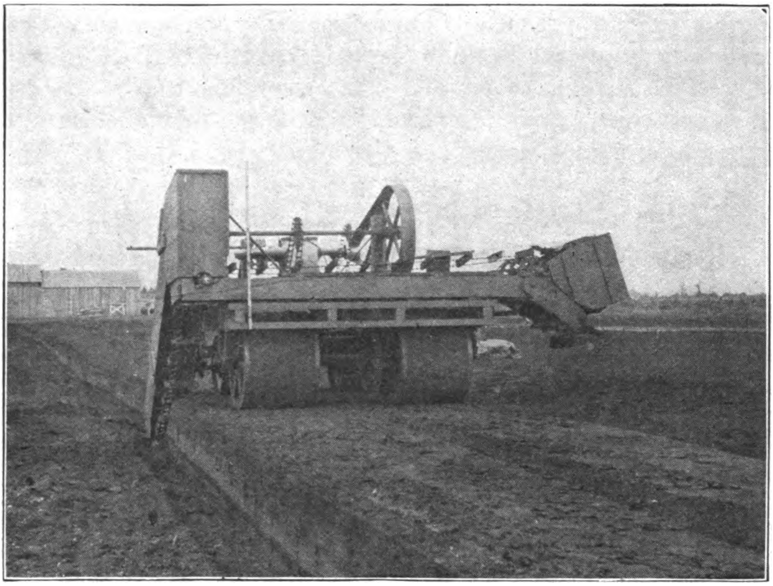
which will compete successfully with coal. There is, undoubtedly, a great future for peat fuel in this country, and I have no doubt we are on the eve of an immense development of the industry.

Peat briquettes seem to be especially well adapted for use in grates. They ignite readily, a small handful of kindling being all that is required to start the fire. Soon after ignition, the peat gives off a bluish flame, which soon turns to a bright yellow, and increases in volume until the whole grate is filled with flame, rising nearly 2 feet above the fuel and throwing out a steady heat of considerable intensity. This flame continues for about an hour without renewal of fuel, after which there remain the glowing peat coals, the fixed carbon

of the peat. The proportion of heat units found in a good sample of peat is, I am told, in the ratio of 5 to 7 of those in anthracite. Many people prefer the peat for light firing, especially in spring and fall, as a quicker fire can be made, and it can be better controlled than a coal fire.

It is proper to say in this connection that the use of peat fuel for heating during the coldest winter months in a northern climate, where heavy firing is required, will not in all respects prove as satisfactory as coal, particularly anthracite, for the reason that it burns out more quickly.

This difficulty can be largely overcome, I am told, by adding a small quantity of coal to the peat when the fire is fixed for the night. It should be remembered that to secure the best results in burning peat for domestic fuel a different method is required from that



employed in the burning of coal or wood. Stoves and furnaces must also be especially adapted for the use of the fuel. In this country, however, the furnaces employed for peat are the same as those used for coal or wood, with the exception of the grate in the fire pot, a fine mesh being necessary to prevent the burning peat from falling through.

Another point in connection with peat fuel briquettes is that the manufactured product must at all times be kept dry. Contact with water renders the peat practically valueless as fuel, hence care in transporting and housing it is of the utmost importance.

I am informed that about 500 tons of peat fuel were manufactured at the plant at Beaverton during the last season, nearly all of which was sold for home consumption. A few carloads of this fuel were shipped to Toronto, where it retailed at from $4.50 to $4.75 per ton.

The illustrations in this article are those of Mr. Dobson's patent peat harvester and press. These machines, as well as the other equipment described, are made and sold by the Peat Machinery Supply Company, Limited, of Toronto and Beaverton.

E. N. GUNSAULUS, *Consul.*

TORONTO, *April 1, 1903.*

BRITISH COLUMBIA.

Consul A. E. Smith, of Victoria, reports under date of January 6, 1903:

Briquetted fuel is neither produced nor sold in this district. The supply of natural fuel is so large that there is no demand for the manufactured article. Coal briquettes, however, are brought from Wales to Victoria for the use of the British Navy at Esquimalt. They are made chiefly of coal dust and are in large cakes.

An immense amount of nut and dust bituminous coal is wasted in this district, which in the East would be utilized for fuel. Here it is used for roads, fillings, etc.

Consul L. E. Dudley, of Vancouver, under date of November 13, 1902, says that no briquetted fuel is manufactured or used in that district, so far as he is able to learn. He adds:

At present the supply of coal, bituminous and anthracite, and of wood furnishes sufficient fuel. The material from which briquetted fuel can be made exists here in abundance, fine coal of both kinds, and large fields of peat in the near vicinity of this city which would be immediately available in case of a scarcity of other fuel.

MANITOBA.

Consul W. H. H. Graham writes from Winnipeg, November 15, 1902:

Briquetted fuel is not manufactured or used in this district.

There are extensive fields of lignite coal in the district, convenient to market, of little commercial value in its raw state, that would form an excellent base for the manufacture of such fuel. The high price of fuel of all kinds in the district, and the abundance and cheapness of soft coal, indicate that the manufacture of briquetted fuel would be highly remunerative here.

NOVA SCOTIA.

Consul G. N. West writes from Sydney, November 21, 1902:

No briquetted fuel is now manufactured here.

Previous to 1897, there was manufactured at Port Morien, about 25

miles from Sydney, by a private company, a briquette composed of coal dust, slack coal, and pitch, which was molded into forms about 12 by 6 by 4 inches in size. The greatest output in any one year did not exceed 500 tons. They were disposed of in Nova Scotia and the upper provinces. I am informed by parties here who used a few of them that they gave satisfaction so far as heat and cleanliness were concerned, both for use in open grates and furnaces. At that time, however, bituminous coal was so cheap that the manufacture was not a profitable investment and it was entirely abandoned, the Dominion Coal Company buying up the patents and rights. Since 1897, the Dominion Coal Company has not operated the plant, but has dismantled it, as its entire output of coal has been required to meet contracts.

JAPAN.

NAGASAKI.

There is only one briquetted fuel manufactory in this district, the Rentan Kaisha, at Nagasaki. This plant is under contract to sell its entire product to the Japanese admiralty at 16 yen ($7.97) per ton at the factory. It is capitalized at 1,000,000 yen ($498,000).

The quantity of briquettes manufactured in 1902 was 50,000 tons, in the production of which 92 per cent of smokeless coal dust and 8 per cent of pitch were used.

The cost of manufacture is said to be about 13 yen ($6.47) per ton, coal dust costing 5.33 yen ($2.65) and pitch (Japanese) 70 yen ($34.86) per ton.

Before it is mixed with the pitch, the coal dust is washed thoroughly in fresh water. During the washing a loss of 25 per cent is sustained.

The capacity of the local plant per day of ten hours is 170 tons, and the employees number 50 skilled workmen, at 1.50 yen (75 cents) per day, and 200 coolies, at 50 sen (24.9 cents) French briquetting machines are used.

The company contemplates doubling the capacity of its factory at an early date. To that end another machine has been lately purchased in France. With the new machine, the plant will be in condition to make further contracts.

It is rumored that a very large plant for the manufacture of briquetted fuel is about to be established in this district, in Yamaguchi Ken, near Shimonoseki, but I am as yet unable to learn the details. There is no doubt but that the manufacturing of briquetted fuel will steadily increase in this part of Japan.

CHARLES B. HARRIS, *Consul.*

NAGASAKI, *January 21, 1903.*

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Name	Date taken	Date ret'd